EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-01

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Model, Machine and Fabrication

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:
Provide technician support for design, fabrication, and assembly of complex electronic circuitry including personal computer hardware, operating systems, breadboards, printed circuit boards, and networks.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
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Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Richard Valentine (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-4437 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 8-6-13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Statement of Work
For EP-C-09-027 WA 4-01
Model, Machine, and Fabrication Shop Support

Purpose : This Work Assignment shall provide shop support for research and development projects at EPA/RTP/NRMRL/APPCD, NERL, NHEERL, AND NHSRC.

Statement of Work : The Contractor shall provide technical and trade support for pilot scale, bench scale, and process measurement instrumentation including design, fabrication, modification and repair of research and development equipment and facilities. Examples of support include preparation of custom designs and layouts for innovative sampling apparatus and instrumentation, and installation or repair of pollution control equipment such as combustors, baghouses, diesel engines, refrigeration equipment, dynamometers, wind tunnels, and HVAC or building utility systems.

The Contractor shall provide machinists, fabricators, and other trade personnel skilled in the fabrication of research equipment from raw materials such as stainless steel, aluminum, Plexiglas, Teflon, sheet metal, PVC, wood, or rubber. The Contractor shall outfit or modify research vehicles as directed by the WAM.

The Contractor shall operate specialized equipment in the NRMRL/APPCD Machine and Fabrication Shop. Typical skills include machining, welding, cutting, plumbing, carpentry, and assembly of technical apparatus into working systems. The Contractor shall provide machinists skilled in the use of engine lathes, milling machines, Computer Numeric Controlled (CNC) machines, saws, drill presses, and other standard machine shop equipment. The Contractor shall provide licensed electricians for power wiring of equipment and circuitry as follows :

The Contractor shall provide technician support for design, fabrication, and assembly of complex electronic circuitry including personal computer hardware, operating systems, breadboards, printed circuit boards, and networks. Contractor technician shall have experience with schematic drawings, test equipment such as multi-meters, signal generators, and oscilloscopes. Contractor shall have experience in fabricating custom electronic devices and cables as well as experience in the repair of scientific instrumentation such as gas analyzers, chromatographs, data acquisition systems, and laboratory equipment such as ovens. Contractor shall have specialized experience in troubleshooting and repair of industrial electric/electronic controls and computer-to-instrument interfaces such as RS232 and USB.used on pilot and bench scale scale equipment.

The Contractor shall maintain Government-furnished equipment in proper working condition. Repairs and maintenance of such equipment shall be coordinated with the WAM.

The Contractor shall provide the WAM with weekly electronic time accounting which shall include the Branch/organization for whom the work was performed.

The Contractor shall adhere to all EPA and local Health and Safety regulations, observe good working practice, and operate in accordance with EPA/RTP's Environmental Management System (EMS) policies and the RTP Chemical Hygiene Plan.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-01

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Model, Machine and Fabrication

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

[ ] Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): [ ]

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Richard Valentine (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-4437 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature)	3/21/13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-01

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Model, Machine and Fabrication

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2):

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Richard Valentine (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4437 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 3/21/13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Statement of Work
For EP-C-09-027 WA 4-01
Model, Machine, and Fabrication Shop Support

Purpose : This Work Assignment shall provide shop support for research and development projects at EPA/RTP/NRMRL/APPCD, NERL, NHEERL, AND NHSRC.

Statement of work : The Contractor shall provide technical and trade support for pilot scale, bench scale, and process measurement instrumentation including design, fabrication, modification and repair of research and development equipment and facilities. Examples of support include preparation of custom designs and layouts for innovative sampling apparatus and instrumentation, and installation or repair of pollution control equipment such as combustors, baghouses, diesel engines, refrigeration equipment, dynamometers, wind tunnels, and HVAC or building utility systems.

The Contractor shall provide machinists, fabricators, and other trade personnel skilled in the fabrication of research equipment from raw materials such as stainless steel, aluminum, Plexiglas, Teflon, sheet metal, PVC, wood, or rubber. The Contractor shall outfit or modify research vehicles as directed by the WAM.

The Contractor shall operate specialized equipment in the NRMRL/APPCD Machine and Fabrication Shop. Typical skills include machining, welding, cutting, plumbing, carpentry, and assembly of technical apparatus into working systems. The Contractor shall provide machinists skilled in the use of engine lathes, milling machines, Computer Numeric Controlled (CNC) machines, saws, drill presses, and other standard machine shop equipment. The Contractor shall provide licensed electricians for power wiring of equipment and circuitry.

The Contractor shall maintain Government-furnished equipment in proper working condition. Repairs and maintenance of such equipment shall be coordinated with the WAM.

The Contractor shall provide the WAM with weekly electronic time accounting which shall include the Branch/organization for whom the work was performed.

The Contractor shall adhere to all EPA and local Health and Safety regulations, observe good working practice, and operate in accordance with EPA/RTP's Environmental Management System (EMS) policies and the RTP Chemical Hygiene Plan.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-02

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	GHG and HAP Measurements Metho

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Jeff Ryan (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-1437 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 3-27-13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Statement of Work
For WA 4-02
GHG and HAP Measurements Methods Development Support to Program Offices

Project Description:

With the implementation of ORD's Path Forward initiative, the Air, Climate, Energy (ACE) research component includes targeted research specifically to support the Program Office's and their emissions measurement methods development needs. This WA is intended to support several research "tasks" (ACE Tasks 222, 096, and 224) identified in the ACE Research Action Plan. Moreover, this WA is intended to implement research that encompasses multiple OAR emissions measurement methods development topics and needs.

These include:

- Performance of hydrochloric acid (HCl) continuous emission monitors (CEMs) to support regulatory compliance applications
- Performance of HCl Reference Methods as they pertain to HCl monitoring certifications
- Performance of nitrous oxide (N20) CEMs to support Greenhouse Gas (GHG) monitoring
- Performance of carbon monoxide (CO) CEMs at low concentrations
- Evaluation of Fourier Transform Infrared (FTIR) for the measurement/monitoring of organic Hazardous Air Pollutants (HAPs)
- Evaluation of innovative measurement/monitoring approaches and technologies
- Evaluation of mercury (Hg) speciated measurement quality approaches and technologies

The purpose of this WA is to conduct research that targets the regulatory research needs identified above. This research support is expected to require laboratory and pilot-plant testing in order to fully understand the quality of the measurement technologies under investigation. An additional purpose of this WA is to support maintenance and operations of the Multipollutant Control Research Facility (MPCRF). Due to the considerable and lengthy maintenance requirements occurring in FY 2012, many of the same project objectives remain in FY 2013.

Project Objectives:

The primary objective of this project, and therefore the primary level of effort in the WA, is to demonstrate the readiness and quantitative measurement performance of commercially available, HCl and N2O gas analyzers or CEMs for point source monitoring and compliance measurement application. For HCl CEMs, the primary focus is the quality of low level (~ 2 ppm) measurements associated with emissions from coal-fired power plants and cement and lime kilns. A desired outcome of this work is to generate data that will support the formal development of HCl monitoring procedures. Another major objective of this project, is to assess the suitability of existing monitoring (i.e., PS-2, Part 75) and instrumental Reference Method (i.e., Method 7E, Method 320, ASTM D 6348-03) approaches that can be used to establish formal EPA, N2O-specific monitoring specifications and procedures and Reference Methods that can be used to support GHG regulatory actions.

Another major objective of this WA is to determine the potential suitability of FTIR as well as other innovative monitoring technologies, as a regulatory compliance monitoring tool for organic HAPs. Formaldehyde, benzene and acrolein are of primary interest. Technology sensitivity (detection limits), proper wavelengths for quantitation, spectral interferences, status and availability of calibration standards are examples of associated considerations. It is anticipated that this work shall require a combination of theoretical and empirical information gathering including some pilot-plant testing on the MPCRF. An additional objective is to consider potential changes to Method 320 so that a revised version can be proposed.

Another objective of this WA is to examine the quality of speciated Hg measurements for emissions characterization purposes. Such measurements are particularly important, yet increasingly complicated, in high particulate matter (PM) environments (e.g., upstream of pollution control devices/systems). Several Hg speciating methods are currently available (e.g., Ontario-Hydro and Method 30B with KCl traps), however their measurement performance is relatively unknown. An independent technique such as the Flue-gas Unfiltered Mercury Emissions (FUME) method, can be used to verify measurement quality. This WA will be used to perform pilot-plant testing to evaluate approaches for assessing the quality of speciated Hg measurements.

This WA is a continuation of WAs 3-02.

Statement of Work:

TASK 1. Work Plan, Reporting, Budget, And WA Management

The contractor shall prepare and deliver to the WA manager (WAM) a work plan and budget within 20 days of WA effective date. The work plan must include a description of how the contractor shall accomplish each task, along with a breakdown of level of effort by professional level per task; a cost breakdown per task, and any underlying assumptions used. The contractor shall conduct activities necessary to manage the WA, including at least weekly communication with the EPA WAM.

TASK 2. Preparation of New WA QAPP

The contractor shall prepare and deliver a new WA QAPP(s). The QAPP shall be developed according to the requirements in Appendix #1 to this Statement of Work. Several individual QAPPs are likely. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

TASK 3. Pilot-Plant Testing of HCl CEMs

The contractor shall conduct testing on EPA's Multi-Pollutant Combustion Research Facility (MPCRF) to evaluate the quantitative measurement performance of HCl CEMs under actual and

varied combustion conditions. Tests shall consider natural gas and coal combustion conditions as a minimum. Quantitative performance of the HCl CEMs shall include use of EPA Reference Methods (including use of FTIR) as comparative references. Emphasis shall include the lowest concentrations that can be measured reliably. Concentrations in the 0.5 to 2 ppm range are of primary interest. The candidate HCl CEMs technologies shall be as representative as possible of those commercially available. The contractor will be responsible for obtaining the HCl CEMs to be tested. The purchase or leasing of HCl CEMs shall be considered. At least 4 different HCl CEMs are desired to be tested. (Target Completion – 9/30/13)

TASK 4. Pilot-Plant Testing of N20 CEMs

The contractor shall conduct laboratory and pilot-scale combustor testing to characterize the measurement performance of candidate N20 analyzers. These characterizations shall focus on spectral interference test approaches such as that found in 40 CFR Part 60 Method 7E. Testing shall be conducted with simulated and actual emission environments (e.g., fossil fuel combustion). Emphasis shall also include the lowest concentrations that can be measured reliably as well as concentrations anticipated at Adipic and Nitric Acid plants. The contractor shall also determine the feasibility of including an FTIR as part of these tests. (Target Completion – 11/1/13)

TASK 5. Combustion Testing of VOC Measurement/Monitoring Technologies

The contractor shall conduct laboratory and pilot-scale combustor testing to characterize the measurement performance of candidate VOC measurement/monitoring technologies including, as a minimum, FTIR and Jet-REMPI technologies. The ultimate intent is to gain an indication of the lowest concentrations that can be potentially measured. The combustion environment and associated complexities shall be considered in addition to fundamental aspects such as FTIR system path length, appropriate quantitation wavelength(s) and spectral/data resolution. Quantitative measurement performance shall include evaluation by dynamic spiking. Emphasis is to be placed on the HAPs considered to be target analytes from combustion sources (e.g., formaldehyde, acrolein, benzene and benzene-like, and the halogenated species). (Target Completion - 12/1/13)

TASK 6. Draft Performance Specification and Reference Method Measurement Methods

The contractor shall prepare draft versions of theoretical N2O monitoring and reference method procedures. The contractor shall use 40 CFR Part 60 Performance Specification 2 and Reference Method 7E as templates. The EPA WAM will provide the electronic versions of these methods to the contractor. The EPA WAM will be responsible for finalizing these documents. (Target Completion – 3/1/14)

TASK 7. Evaluation of Hg Compressed Gases and Ability to Achieve NIST-Traceability

The contractor shall evaluate elemental Hg compressed gas standards to determine if they can meet EPA requirements for NIST traceability to the extent that they can be used for regulatory purposes.

TASK 8. Experiments to Resolve the Elemental vs. Oxidized Hg Discrepancy

The contractor shall conduct experiments to further characterize the fundamental differences between NIST traceable solution HgCl2 generators and Hg0 generators. Ideally, these experiments will indicate which gas standard is accurate and which is not. Should this be the case, the contractor shall propose experiments to determine the reason for the discrepancy. (Target Completion – 8/1/13)

TASK 9. Speciated Measurement Quality Testing

The contractor shall develop and evaluate approaches suitable for assessing the speciated Hg measurement quality of APTB's Hg CEMs associated with pilot-plant testing operations. Approaches shall include as a minimum probe floods and dynamic spiking with elemental and oxidized hg gas standards as well as independent, reliable elemental Hg measurements such as FUME. (Target 8/31/13)

TASK 10. Speciating Sorbent Trap Testing

The contractor shall conduct laboratory testing to evaluate speciating sorbent traps. Specific focus shall be placed on the level of performance achieved while conducting the Field Recovery Test component of the RM. Field Recovery Tests shall be conducted in replicate under varied conditions with multiple sorbent trap materials and shall be limited to analysis by the Thermal Analysis (Lumex) technique. (Target 9/30/13)

Several sub-tasks have been identified:

1. The contractor shall perform laboratory tests to determine the acceptable upper temperature range that speciated traps can be used. These tests shall include approaches to mitigate temperature effects, including air-cooled probes
2. The contractor shall perform proof of concept testing on APPCD pilot-plant combustors demonstrating the performance of the air-cooled probes.
3. The contractor shall perform pilot-plant testing using quad probes, preferably in a high temperature environment, to demonstrate the speciated measurement quality
4. The contractor shall perform speciated measurement tests concurrent with Ontario-Hydro samples and speciating Hg CEMs, including application of the FUME method.

TASK 11. Multi-Pollutant Combustion Research Facility – Repair and Operational Support

The majority of the pilot-scale research identified above will take place using APPCD/APTB's Multi-Pollutant Combustion Research Facility (MPCRF). This WA will support the repair, maintenance, and operations of this research facility. This WA will also procure and provide fuel (primarily coal) and fuel storage for daily operations and testing. In addition, this WA will support the repair, maintenance, and operations of this research facility by procuring necessary repair parts (e.g., tubing, fittings, thermocouples, gauges, etc) as well as expendable materials (e.g., filters, reagents, gases, etc)

TASK 12. Draft and Final Reports

Several data reports are required as a function of this WA. Known reports include, but are not limited to: Draft Data - Test data summaries for each location, brief summaries of associated testing activities and procedures, copies of all ancillary data forms and log sheets (with 60 days of completion of testing); Final Data Report – All raw and summarized measurements data, QA/QC report of data quality and data limitations, if any.
Specifically, data from all tests will be reported in electronic files. They will be assembled in individual Excel notebooks that are unique for each test. Each Excel notebook will consist of:

- Summary page to summarize relevant information from the test
- Narrative page that will give a description of the test, analytical method, deviations from operating procedures during the analysis, deviations from specifications in the test plan or QAPP, problems encountered during the test or analysis, questions or issues concerning individual data points, special actions taken to verify data, data that should be further evaluated by the reviewer, and questions and issues to be addressed in preparation of the final data summary and report
- Data pages which contain all of the raw data as compiled by the individual instruments for field samples, lab samples, and QC samples
- QA/QC pages in which all pertinent QA/QC data are presented

(Target Completion – to be determined by WAM).

QA/QC Requirements

A new QAPP will be required for this WA. The QAPP shall be developed according to the requirements in Attachment #1 to this Statement of Work. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

Reports of Work:

The contractor shall prepare a work plan and budget as described in Task 1 within 20 days of WA effective date. The contractor shall prepare and submit monthly reports in accordance with the terms and conditions of the contract.

Health and Safety Protocols shall be prepared and submitted for approval as required by contractor, APPCD, and SHEM safety personnel.

The contractor shall maintain at least weekly communications with the WAM. Additionally the contractor shall inform the PO and the WAM in writing when 75% of the total funds and/or hours contained in the work plan are expended.

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW) FOR MEASUREMENT & METHOD DEVELOPMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function; 07/14/08 A-2
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X Category III or IV QAPP: prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X QAPP Requirements for Measurement Projects

□ **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

□ **QAPP Requirements for Software Development Projects**

X QAPP Requirements for Method Development Projects

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

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NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of

samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.

3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.

3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

4.5 Describe the method for uniquely numbering each sample.

4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

NRMRL QAPP REQUIREMENTS FOR METHOD DEVELOPMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Provide a description of the situation that requires the generation of a new or modified method.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Identify the specific analyte(s) of interest and the matrix/matrices under study.
3.2 Identify the analytical approach that will be used and how it will be optimized for this study. Also describe any tests of interference and analyte stability.
3.2 Identify the method performance metrics (QA/QC checks) that will be used to evaluate the method, including the procedures used. These metrics could include (but are not limited to) positive and negative controls, sensitivity, precision, accuracy, recovery, linearity, specificity, robustness, and range.

4. SAMPLING PROCEDURES

4.1 Provide the requirements for samples that will be used to test the method (including matrix and presence/concentration of analytes).
4.2 If synthetic (i.e., laboratory-prepared) samples are used, describe the preparation of these samples.
4.3 If non-synthetic (i.e., real-world sample) samples are used, address the following:
- describe the sampling design that will be used and the steps taken to assure that representative samples are collected
- discuss or reference each sampling procedure
- provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis
- describe procedures for packing and shipping samples, and provisions for maintaining chain-of-custody, as applicable

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.

5. MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each preparation or analytical procedure to be used, if known. Include steps for preparation, calibration, measurement, quality control, and reporting.
5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. METHOD PERFORMANCE METRICS

For each method performance metric (QA/QC check) identified in Section 3.2, specify the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report, etc.). If a method/SOP will be developed, specify the required format.

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-03

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Measuring the Impact of Port A

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2012 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Sue Kimbrough (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-2612 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name: (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates (Signature)	6-11-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Statement of Work WA 4-03

Measuring the Impact of Port Activities on Air Quality

1.0 Background:

EPA ORD is interested in studying the effect of emissions from port activities on near-field air pollutant levels. As has been established with near-road monitoring, a large emissions source may impact local air quality within several hundred meters of the source. Effects of port expansion extend beyond the borders of the port. As the volume of freight increases, communities near the port and along roadways may experience increased local-scale air pollution due to increased traffic. Near-road research has shown elevated air pollution levels within a few hundred meters of busy roadways, and health effects have been associated with near-road exposures.

High-resolution mobile monitoring is identified as a useful research strategy with respect to identifying the uncertainties identified above. Such an approach would allow for the monitoring of local air quality impacts surrounding a source. Driving-mode mobile monitoring with on-board instruments measuring at ~1Hz allows for a spatial resolution of approximately 20 m at a driving speed of 20 mph. Target measurements for this study are carbon monoxide (CO), carbon dioxide (CO_2), nitrogen dioxide (NO_2), black carbon (BC) and the particulate matter size distribution.

2.0 Task and Method Overview

Under the technical direction of the EPA WA COR, the contractor shall execute a field campaign to monitor the air quality surrounding a port area and related sources (e.g., truck routes, distribution centers) for the purposes of:

1. measuring neighborhood-scale gradients in air pollutants that may be affected by localized emissions from the port and related sources in the harbor area.
2. providing a spatially-resolved data set for comparison with a Community Air Quality Screening Model (COMAQS)

This field campaign will take place in the Charleston, SC area.

This study will include the deployment of one mobile monitoring sampling platform equipped with high-resolution air monitoring instrumentation measuring the following species at a 1 Hz sampling rate: CO, CO_2, NO_2, BC, and particle counts. GPS tracking of the car, its speed and its location shall be performed. This all-electric sampling platform shall be deployed to conduct real-time mapping of air pollutants by repeatedly driving specified routes identified by the WA COR. In addition, local meteorology measurements will be conducted using a portable meteorology tower. The electric vehicle and a trailer for transport are on the ARCADIS contract and available for use for this study.

3.0 Description of Tasks:

Task 1. General Support for EPA Mobile Monitoring Sampling Platforms

The contractor shall maintain the operability of the electric vehicle sampling platform and onboard air monitoring instrumentation prior to and during the field measurement campaign. The contractor shall facilitate repair of the sampling platform given failure while at the EPA-RTP location or during field measurements. Monitoring equipment shall be maintained with respect to routine maintenance, audits and /or calibration as previously defined by WA COR-approved operating procedures for electric car environmental monitoring.

The contractor shall be responsible for transporting the mobile monitoring sampling platform for this study to the field site (Charleston, SC area) during the field study and daily local transportation during each field study.

Task 2. Site Selection and Preparation:

The contractor shall visit the selected monitoring site in coordination with the WA COR or their designee as required for the purpose of evaluating field sampling deployments. Final site selection will be determined by the EPA WA COR. It is projected that one planning site visit will be necessary.

The contractor shall identify an appropriate site for sampling platform and equipment storage and re-charging within a 20-mile radius of the project site. This site shall be temperature-controlled, secure, and clean enough to troubleshoot sampling instruments without threat of instrument contamination.

Deliverable 2.1: Contractor shall submit a GMAP vehicle site logistics plan specific to the Charleston, SC field site to the EPA WA COR prior to initiating field measurements. For the site, the plan shall include information regarding the vehicle storage location as well as procedures to be followed in case of vehicle break-down while in use.

Task 3. Field Measurements:

Following the completion of Tasks 1 and 2, the contractor shall execute an 18-22 day field monitoring study in Charleston, SC to map air pollutants (CO, CO_2, NO_2, BC, and particulate matter measured at 1 Hz). GPS identifiers (location, speed) shall be collected during monitoring associated with the specific study routes. In addition, local meteorology measurements (wind speed/wind direction) shall be conducted using a portable meteorology tower.

Field sampling for a total of 18-22 sampling days for the Charleston, SC area, and may include both weekday and weekend sampling days (morning or afternoon). The specific sampling timeframe and location will be determined by the EPA WA COR. For a given sampling day, driving-mode monitoring shall be conducted for 3 hours, followed by 1 hour of sampling while parked. In addition to the monitoring period, transportation, set-up, and break-down are estimated to take approximately 4 hours per sampling day.

Field sampling shall be conducted on up to 4 different driving routes in the port of Charleston area. The route(s) are to be determined by the EPA WACOR in consultation with the contractor. Each driving route shall be repeated at least once during the field campaign. The route shall be driven multiple times during the sample period (e.g., a weekday morning) keeping in mind the driving range and the need to conduct 1 hour of sampling while parked.

The start and stop of the sampling timeframe, as well as determination of the routes to be taken and the points where stationary monitoring shall occur will be determined by the EPA WA COR. The field sampling configurations and quality assurance requirements will be described in a Category III QAPP which will be provided by the EPA WA COR. This QAPP will adhere to NRMRL QAPP requirements for measurement projects (see Attachment #1 to this statement of work). After preparation, the QAPP shall be reviewed and approved by the ARCADIS work assignment leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the ARCADIS work assignment leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the ARCADIS work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA Quality Assurance Staff.

In the event that inclement weather or other unavoidable circumstances prevent field sampling, a sampling day may be cancelled and rescheduled to meet the target of 18-20 sampling days. Under such cancelation circumstances, ARCADIS shall inform the WA COR at the earliest time convenient to ensure WA COR knowledge of the schedule change.

Each sampling day, the contractor will be responsible for transporting the GMAP sampling platform and equipment to and from the site. The contractor shall prepare for and conduct measurements of gaseous species (CO, CO_2 and NO_2) and particulate matter (counts, BC) onboard the all-electric sampling platform. The measurements shall be taken at 1 Hz. The contractor shall provide the necessary calibration gases for gas-phase analyzers (CO, NO_2, CO_2) to meet QAPP requirements. In addition to the collection of air monitoring data, the contractor shall also prepare for and collect local meteorology measurements throughout each sampling period and document local emission activities (e.g., stalled traffic, visible combustion sources,). The field sampling campaign shall be manned with personnel with sufficient expertise to ensure a minimum 80% completeness of the Data Quality Objective.

Deliverable 3.1: The contractor shall provide raw time-stamped concentration and meteorology data to the EPA WA COR within 3 days of data collection, including GPS coordinate and speed values. The data to be reported and formatting will be described in the QAPP.

Deliverable 3.2: The contractor shall provide a complete data package (DP) for each route within 2 weeks of field monitoring completion. Comma-delimited data files are acceptable. The DP shall include field notes, including any and all photographic records documenting the on road and stationary monitoring activities, as well the quality-assured field data, in-field quality indicators, and calibration checks. No contractor-generated report will be required as a deliverable.

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW) FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function; 07/14/08 A-2
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X QAPP Requirements for Measurement Projects

□ QAPP Requirements for Secondary Data Projects

□ QAPP Requirements for Research Model Development and/or Application Projects

□ QAPP Requirements for Software Development Projects

□ QAPP Requirements for Method Development Projects

□ QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

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NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-04

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Carcass Disposal Feas. Study

Contractor	Specify Section and paragraph of Contract SOW
ARCADIS U.S., INC.	1.1, 1.2, 1.6, 1.8, 2.0, 7.0

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 09/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2): ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Paul Lemieux (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-0962 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 11/21/13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

PERFORMANCE WORK STATEMENT
for
Infectious Carcass Disposal Pretreatment Feasibility Study

PURPOSE OF WORK ASSIGNMENT

The work will involve evaluating the feasibility of grinding carcasses on the farm, treating the ground material to inactivate pathogens (as appropriate) in a manner suitable for landfilling or rendering, and loading the treated material into appropriate vehicles for transport to disposal.

Note: This PWS represents the full scope of the Interagency Agreement from DHS that is to fund this effort. Depending on when the WA is awarded and the end of the period of performance of the WA, it is expected that Tasks 1 through 3 will be completed. Tasks 4, 5, and 6 will not be started, and Task 7 will be partially complete.

BACKGROUND

The Department of Homeland Security (DHS) is committed to using cutting edge technologies and scientific talent in our quest to make America safer. DHS' Science & Technology (S&T) Directorate is tasked with researching and organizing the scientific, engineering and technological resources of the United States and leveraging these existing resources into technological tools to help protect the homeland.

EPA is designated a support Agency, under the National Response Framework, to support the U.S. Department of Agriculture's (USDA's) Animal and Plant Health Inspection Service (APHIS) activities in agricultural emergency response. EPA is also a lead agency under Section 208 of the Food Safety Modernization Act (FSMA) and is tasked under the FSMA to develop model plans for protecting the nation's food and agricultural infrastructure in such a way to protect human health and the environment.

As identified in Homeland Security Presidential Directives (HSPDs) on Defense of United States Agriculture and Food (HSPD-9) and Biodefense for the 21st Century (HSPD-10), mechanisms for protection of critical infrastructure are fundamental components as part of any comprehensive strategy for biodefense. Focused development and deployment of technologies to foster proactive protection, response and recovery is necessary to protect against any significant infectious disease threat. In the case of high-consequence livestock pathogens, these tools play a crucial role in the preventative, mitigation and recovery phases of an outbreak.

This Performance Work Statement (PWS) describes the requirements for addressing an identified gap related to disposal of infectious large animal carcasses in the event of a foreign animal disease outbreak. Addressing this gap will enable APHIS, and the entire

agricultural response community, to more effectively respond to a foreign animal disease outbreak in the US, should one occur.

The work will involve evaluating the feasibility of grinding carcasses on the farm, treating the ground material to inactivate pathogens (as appropriate) in a manner suitable for landfilling or rendering, and loading the treated material into appropriate vehicles for transport to disposal.

DETAILED TASK DESCRIPTIONS

Task 1 – Development of a Quality Assurance Project Plan

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2 – Literature Review

The contractor shall identify, collect, evaluate, and summarize all available articles, reports, guidance documents, regulations and other pertinent information related to pretreatment for transport of infectious carcasses for disposal by rendering or permitted landfill. The WACOR and members of the DHS S&T FAD working group will provide whatever information is already known to be available for this task. The Contractor shall collect additional needed published or interview information to fill any identified gaps. The literature review will be transmitted to the WACOR as a deliverable, in the form of a memo, an Excel file with the list of references and any annotations, and an EndNote library with the database fields filled in.

Task 3 – Identify Alternatives

The Contractor shall develop alternatives for feasibility evaluation in accordance with EPA guidelines for performing feasibility studies, as applicable. The development process may include:

- Develop Pretreatment Objectives
- Develop General Pretreatment Actions
- Identify Volumes or Amounts of Media
- Identify and Screen Pretreatment Technologies and Process Options
- Evaluate Process Options
    - Effectiveness
    - Implementability Evaluation

    - Cost Evaluation
- Assemble Alternatives
- Screen Alternatives
    - Define Alternatives
        - Specific Objectives
        - Define Media and Process Options
    - Screening Evaluation
        - Effectiveness Evaluation
        - Implementability Evaluation
        - Cost Evaluation
        - Innovative Technologies
    - Alternative Screening
        - Guidelines for Screening
        - Selection of Alternatives for Detailed Analysis

Task 4 – Assess Feasibility of Alternatives (NOTE: This task is likely to be done in a follow on work assignment and is not within the scope of this WA. It is included here for completeness' sake so that the Contractor will be able to see the progression of the work and come up with a better work plan)

After the alternatives have been selected for detailed analysis, the Contractor shall assess each alternative for feasibility. The following process may be used:

- Define Alternatives to be Assessed
- Outline Evaluation Criteria
- Analyze Each Alternative Individually
    - Overall Protection of Animal Health and the Environment
    - Compliance with regulatory requirements
    - Long-Term Effectiveness and
    - Reduction of Toxicity, Mobility, or Volume Through Treatment
    - Short-Term Effectiveness
    - Implementabilty
    - Cost
    - Regulatory Agency Acceptance
    - Community Acceptance
- Present Individual Analyses
- Compare Alternatives
- Present Comparative Analysis
- Recommend Preferred Alternative(s)

Task 5 – Obtain Subject Matter Expert (SME) Peer Review (NOTE: This task is likely to be done in a follow on work assignment and is not within the scope of this WA. It is included here for completeness' sake so that the Contractor will be able to see the progression of the work and come up with a better work plan)

Throughout this project, the Contractor shall engage subject matter experts in a structured and documented manner to achieve a peer-reviewed outcome. This task may include:

- Identify SMEs, with input from DHS and the WACOR;
- Invite identified SMEs to participate in process;
- Identify milestones in process where SME input will be solicited;
- Organize conference calls/webinars to discuss SME input, including scheduling, preparation and dissemination of read-aheads/agendas, and recording/distribution of meeting notes.

Task 6 –Report Preparation (NOTE: This task is likely to be done in a follow on work assignment and is not within the scope of this WA. It is included here for completeness' sake so that the Contractor will be able to see the progression of the work and come up with a better work plan)

The Contractor shall compile the results from Tasks 2-5 into a comprehensive report which documents the activities performed, the results collected, and the recommended actions. The deliverables from Task 5 shall be included as appendices to the report if applicable. It is assumed the report will be issued in draft suitable for the EPA review process.

Task 7 – Site Visits and Meetings

This task involves attending site visits and meetings as needed to accomplish scope of work objectives. In addition, it should be assumed there will be a kick-off meeting, two progress meetings, and a final study presentation meeting with the technical team in the Washington DC metropolitan area or else over a webinar over the course of the project. The Contractor shall draft minutes for each meeting and distribute them to the project team electronically.

DELIVERABLES

1. Planning Meetings and Meeting Notes: The WACOR and contractor's project manager shall arrange project meetings to discuss Task-specific progress, issues, and action items. Where possible the meetings will be run via webinar.

2. Monthly Task Progress and Cost Reports: The Contractor's monthly report to EPA shall summarize work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges.

3. Quality Assurance Project Plans (QAPPs): The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The contractor shall prepare a QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements

provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.

4. Literature Search Results: The literature review will be transmitted to the WACOR as a deliverable, in the form of a memo, an Excel file with the list of references and any annotations, and an EndNote library with the database fields filled in.

5. Interim Report(s): The results from Task 3 and Task 4 will be transmitted to the WACOR as one or more interim memo report(s) for internal distribution (not for external publication).

6. Feasibility Study Outline: An outline will be developed for the Feasibility Study. It will be reviewed by the WACOR, DHS S&T rep and other project team members. It will be revised to address their comments and this outline will be used to develop the detailed Feasibility Study.

7. Final Report: Task 6 details the Final Report requirements.

SCHEDULE

Deliverable	*Schedule*
QAPP Draft	October 1, 2013
QAPP Final	November 1, 2013
Literature Review Final	November 30, 2013
Feasibility Study Outline	January 15, 2014
Initial Alternatives Identification	June 30, 2014
Detailed Alternatives Analysis Draft	September 1, 2014
Detailed Alternatives Analysis Final	September 31, 2014
Feasibility Study Draft Final Report	January 1, 2015
Feasibility Study Final Report	March 1, 2015
Meeting Minutes	2 weeks after meeting as required

OTHER CONSIDERATIONS

Travel – it is expected that the Contractor shall need to travel to the Washington DC area for a face-to-face meeting with the DHS contact, the WACOR, and other subject matter experts twice through the period of performance.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-06

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Impact of Green Building Produ

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Ken Krebs (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-2850 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 4-11-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Version 1.0
03/16/13

FY13 Scope of Work

WA 4-06

WA Title: Impact of Green Building Products and Risk Management Solutions on Indoor Air Quality

1. Purpose

The overall objective of this project is to develop, demonstrate, and evaluate sustainable practices for indoor environments. Sustainable practices are decisions and actions that consider, minimize, and harmonize the impact of materials and energy use on human health and the environment. Through integrated multidisciplinary and focused research, Indoor Environments Management Branch (IEMB) develops knowledge and tools that enable evaluation of sustainable practices for indoor environments. IEMB develops tools to characterize sources of indoor contaminants and investigates the relationships between sources of contaminants, the built environment and potential exposure to individual compounds and complex mixtures while considering the impacts of risk management solutions on building energy use. For example, IEMB investigates the impact of green building products on indoor air quality and develops risk management solutions where green building practices or products may potentially improve or impair indoor quality. Specific tasks are itemized in the section titled "Task Descriptions."

2. Background

Rapidly increasing energy costs coupled with increasing market acceptance of "green" or sustainable residential building design has resulted in an increased demand for sustainable building practices and "green" building products. However, sustainable "green" building practices (e.g., super insulated, tight buildings constructed with recycled or "natural" products) may inadvertently result in degraded indoor environmental quality or other downstream environmental challenges. As a component of "cradle to cradle" stewardship of materials and energy, there is a need to understand the impacts on the indoor environment of: (1) emissions, sorption and re-emission of organic and inorganic compounds from "green" building materials; (2) transport within the built environment; and (3) efficacy of control technologies such as air and surface cleaning, and their affect on building energy use.

Key pollutants of concern include endocrine disrupting compounds such as brominated flame retardants, phthalates, and perfluorinated compounds associated with consumer products, neurotoxins such as elemental mercury released from the debris field of broken compact fluorescent light bulbs, and air toxics such as formaldehyde released and sorbed by some indoor materials and surfaces. Formaldehyde is one key toxic pollutant in the National Risk Management Research Laboratory (NRMRL) Indoor Air Strategic Plan. It is among the US Environmental Protection Agency (EPA) listed urban air hazardous air pollutants (HAPs) and one of the predominant VOCs emitted from building products.

Primary emissions from materials and products as well as sorption and re-emission from surfaces are key factors that govern indoor concentrations.

There are three components of IEMB's research approach: (1) Develop source models that simulate emissions from green building products, (2) develop sorption/re-emission models for green building products, and (3) determine the reliability of source/sink models in full-scale indoor environments. The source emissions model parameters obtained from EPA's chamber tests will be applied to IAQ models to determine the impact of the use of "green" building design products on indoor concentrations of organic and inorganic contaminants. Source and sink models and control strategies will be evaluated by studies conducted in APPCD's Research Test House (RTH), operated by the contractor. Specific tasks and the schedule for tasks to be conducted in the RTH shall be described in amendments to this work assignment or described in other task-specific work assignments.

3. Task Descriptions

The contractor shall conduct the following tasks:

The contractor shall maintain the research test house in ready mode for model evaluation or other studies as described in amendments to this work assignment or described in separate work assignments that utilize the research test house. Specifically, the contractor shall ensure that:

All miscellaneous and standard operating procedures (MOPs and SOPs) are accurate and up to date for contractor operated measurement or control systems. At a minimum, the contractor shall ensure that:

- The data acquisition system is functional
- At least two temperature sensors and two RH sensors are functional
- The B&K Multi-gas Analyzer is calibrated for SF6
- The SF6 dosing and sampling system is functional

Per Contract number EP-C-09-027, the contractor shall maintain the instrumentation in the RTH to ensure that the RTH can be utilized for specific research tasks within 30 days of notification through written amendments to this or other work assignments.

4. Reports

The contractor shall provide the EPA work assignment manager monthly progress reports as specified in the contract.

5. Schedule of Tasks, Reports, and Deliverables

The contractor shall provide monthly reports of the RTH operational status. Reports and deliverables for other tasks, including new or revised MOPs or SOPs that are required to support QAPPs developed for specific research tasks to be conducted at the RTH, will be described in amendments to this work assignment.

6. QA/QC

The contractor shall provide input to QA test plans, addendums, technical reports, and manuscripts developed by EPA staff for and from specific experiments to be conducted in the research test house. Data gathering/manipulation shall not begin until the QAPP has been approved by the EPA QA manager. The QA plan shall be developed according to the requirements in Attachment #1 to the Statement of Work. Environmental data collection cannot start until both APPCD and ARCADIS QA staff have received the completed signature page for the QAPP. Specific experiments, schedules and deliverables will be described in amendments to this work assignment.

All draft or revised QAPPs to be implemented by ARCADIS that are submitted for APPCD QA approval must be accompanied by a signature page that is signed by the ARCADIS work assignment leader and ARCADIS QA officer to show that they have reviewed and approved the QAPP. Upon final approval of the QAPP, the APPCD work assignment manager and QA manager shall add their signatures to the signature page to show their review and approval.

7. Suggested Skills

This project will require contractor staff with the following skills: modification and adaptation of scientific apparatus to meet project objectives, sample collection and extraction, data processing and analysis, preparation, operation and maintenance of the RTH.

8. Special Requirements

The contractor shall provide necessary health and safety procedures, documentation, and training to contractor staff to ensure safe conduct of the experiments at contractor controlled facilities.

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW) FOR MEASUREMENT & METHOD DEVELOPMENT PROJECTS WA 4-06

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function; 07/14/08 A-2
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X QAPP Requirements for Measurement Projects

□ QAPP Requirements for Secondary Data Projects

□ QAPP Requirements for Research Model Development and/or Application Projects

□ QAPP Requirements for Software Development Projects

X QAPP Requirements for Method Development Projects

□ QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

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NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

NRMRL QAPP REQUIREMENTS FOR METHOD DEVELOPMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Provide a description of the situation that requires the generation of a new or modified method.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Identify the specific analyte(s) of interest and the matrix/matrices under study.
3.2 Identify the analytical approach that will be used and how it will be optimized for this study. Also describe any tests of interference and analyte stability.
3.2 Identify the method performance metrics (QA/QC checks) that will be used to evaluate the method, including the procedures used. These metrics could include (but are not limited to) positive and negative controls, sensitivity, precision, accuracy, recovery, linearity, specificity, robustness, and range.

4. SAMPLING PROCEDURES

4.1 Provide the requirements for samples that will be used to test the method (including matrix and presence/concentration of analytes).
4.2 If synthetic (i.e., laboratory-prepared) samples are used, describe the preparation of these samples.
4.3 If non-synthetic (i.e., real-world sample) samples are used, address the following:
- describe the sampling design that will be used and the steps taken to assure that representative samples are collected
- discuss or reference each sampling procedure
- provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis
- describe procedures for packing and shipping samples, and provisions for maintaining chain-of-custody, as applicable

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.

5. MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each preparation or analytical procedure to be used, if known. Include steps for preparation, calibration, measurement, quality control, and reporting.

5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. METHOD PERFORMANCE METRICS

For each method performance metric (QA/QC check) identified in Section 3.2, specify the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report, etc.). If a method/SOP will be developed, specify the required format.

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-10

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014	
	Base X Option Period Number	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2):

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Worth Calfee (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7600 FAX Number: 919-541-0496
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates (Signature) 9-12-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK

ENHANCING THE FIELD USE OF THE 37-MM FILTER CASSETTE VACUUM SAMPLING DEVICE

TABLE OF CONTENTS

I. TITLE

Enhancing the Field Use of the 37-mm Filter Cassette Vacuum Sampling Device

II. PERIOD OF PERFORMANCE

The period of performance for this Work Assignment (WA) is from the date of Award to March 31, 2014.

III. SUMMARY OF OBJECTIVES

The proposed work will evaluate options for enhancing the "ease of field use" of the 37mm Cassette type Vacuum Sampling device. The ultimate object is to generate data that can be used to select appropriate sampling devices following a bioterror event. Scientifically-testing sampling methods will provide increased confidence in the ability to characterize contamination following such an event.

IV. RELEVANCE

The products will be used to guide decisions with regard to the selection and application of candidate vacuum-based sampling technologies and methods for characterization of contamination post bioterror incident. The results of this work will be made available through published reports, journal papers, and/or conference abstracts and presentations.

V. BACKGROUND

Methods for detection and characterization of biological agent on surfaces following a bioterror incident include swabs, wipes, and vacuum. The currently-used vacuum-based method utilizes woven collection socks attached to a cardboard nozzle. The sock and nozzle affix to the most upstream end of the vacuum hose, so that agent is captured by the sampling sock and does not contaminate the equipment. Multiple samples can be collected in progression by affixing a new collection sock to the vacuum hose between samples. Some have demonstrated that this method has utility in collection of biological agent (Brown et al., 2007); however most contend that improvements could be made to the method or another vacuum-based sampling device would be more efficient. Some criticisms of the current method are that the vacuum socks often come from the manufacturer with clearly visible holes in the sock seams, and that the filters are too cumbersome for laboratory handling and extraction during analysis. Preliminary data collected by the EPA suggest that none of the currently-available vacuum-based devices are optimal for field use and for laboratory analysis methods. The 37mm cassette device is slightly preferred over the vacuum sock and Trace Evidence Filter devices for reasons including Quality Control, collection efficiency, ease of shipment, sample integrity post-collection, price, and commercially availability. The major criticism of the 37mm device is its required long and tedious sample collection procedure, and relatively small area sampled per sample.

VI. SCOPE

Under this SOW, the contractor, under the direction of the Environmental Protection Agency (EPA) in collaboration with the Centers for Disease Control and Prevention (CDC), will perform a study to evaluate several options for enhancing the "ease of use"

and "collection efficiency" of the 37mm cassette-type vacuum-based sampling device, for collection of biological agent from environmental surfaces.

VII. TECHNICAL APPROACH

A known quantity of *Bacillus* spores will be deposited by aerial dispersion onto large coupons (1 $ft.^2$ or greater) containing carpet. The coupons will then be subjected to vacuum-based sampling according to protocols developed jointly by CDC and EPA. Recovery will be determined for each sampling method according to culture-based microbiological assays developed by CDC. All test parameters, such as test chamber size, coupon materials and sizes, sampling methods, methods of extraction / analysis will be determined by agreement among participating experts from EPA and CDC. The collective set of tests must be able to be completed within the allotted budget.

Table 1. Potential test parameters to vary during experiments

Parameter	Potential Variants
1. Material Surface Types	Carpet and two other material types
2. Coupons and Replicates	The number of replicates shall be determined by the amount of effort and funding available.
3. Nozzle	4 nozzle variations (Standard (control), widened, and bristle-enhanced nozzles are potentials)
4. Pump Type	The standard nozzle and one enhanced nozzle shall be evaluated with two sampling pump types (i.e., Vac-U-Go pump and a personal sampler pump)
5. Traverse Speed	The standard nozzle and one enhanced nozzle shall be evaluated at two collection speeds (traverse speed of sample nozzle across surface)
6. Sampled Area	Evaluate one or two devices over $1ft^2$ and larger sampled areas (up to $4ft^2$)
7. Spore Concentration on Surfaces	The standard nozzle and one enhanced nozzle shall be evaluated against at least two surface concentrations. (i.e., E6 – E7 ft^{-2}, and E2 – E3 ft^{-2})
8. Humidity Level	Two RH levels (30 – 90 %RH) for coupon conditioning after inoculation and before sampling (conditioning for ~48 hours)

VIII. FACILITIES AND MATERIALS

All tasks described in this SOW shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr., unless approved otherwise by the EPA WAM. The sampling activities shall be conducted in the NHSRC's Decontamination Technologies Research Lab (DTRL) located in H-224, H-222, H-122a, and H-130a. The lab contains the necessary equipment for the tasks described herein. The analysis of the biological samples shall be conducted in the Microbiology lab, located in E-386, E-388, and E-390.

IX. TASKS

To achieve the desired objective of this effort, work for this SOW can be broken down into four tasks.

Task 1. Development of a Quality Assurance Project Plan (QAPP)

Project-specific details, including but not limited to number of tests, coupon materials, sampling strategies, analytical techniques, experimental controls, and coupon dosing method shall be outlined in a QAPP. The QAPP shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this IA (see Attachment #1) and the NHSRC QA requirement as defined in qqAttachment #2. No experimentation shall begin before this task is approved by the EPA Quality Assurance Officer (QAO) and by the CDC technical point of contact. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

Task 2. Fabrication of Test Material Coupons and Procurement of Test Supplies

Significant effort is anticipated for fabrication and sterilization of the numerous material coupons needed for testing. Materials will be obtained through outlined EPA procurement processes. Materials shall then be fashioned into coupons for testing.

Task 3. Test Experimentation – Vacuum Device Modifications and Evaluation

At least eight and a maximum of twelve sets of tests shall be conducted in which the 37mm cassette device is evaluated. Some potential modifications to collection procedures or device design include:

1) Increase nozzle width (yet maintain opening cross-sectional area) to increase the width of coverage by a sampling sweep
2) Enhanced nozzle design (enhancing the nozzle characteristics to enhance particle resuspension from surfaces)
3) Evaluate the device using sampling pumps optimized for field use (e.g. disposable pump, battery powered pump, personal sampling pump, etc)
4) Evaluate the collection efficiency (with or w/o modifications) at lower surface concentrations (i e., as low as repeatedly possible).
5) Evaluate a more rapid sweep speed, such that samples could be collected more rapidly using the 37mm device (i.e., 4 x 1ft sweeps per second)
6) Evaluate the efficiency when sampling several area sizes
7) Evaluate the efficiency as a function of spore concentration level
8) Evaluate the efficiency as a function of relative humidity

For these tests, experimentation shall be carried out in accordance with the QAPP. Deviations from the QAPP shall be documented in writing and justified.

Task 4. Report

Following completion of all data collection, a brief report shall be prepared documenting the details of the tests, including methods, quality control measures utilized, collected data, interpreted results, and conclusions. The report shall conform to the EPA style.

X. MILESTONES, DELIVERABLES, AND COMPLETION DATES

QAPP Amendment
A draft QAPP and Work Plan shall be provided within 45 days of the award of this agreement. This shall be provided prior to commencement of the tests described within this SOW. The combined QAPP and Work Plan shall include scope, scheduling, and costing information for each of the tests planned.

Reporting
A Draft Report shall be provided to EPA for review by March 15, 2014.

XI. RESPONSIBILITIES

This project is initiated by the USEPA Office of Research and Development, National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) in Research Triangle Park, NC. This project is a collaborative effort with the US Centers for Disease Control and Prevention in Atlanta, GA. The U.S. EPA WACOR shall be Dr. M. Worth Calfee (phone 919-541-7600, email calfee.worth@epa.gov). Dr. Sang Don Lee shall be alternate WACOR.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-11

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014	Evaluation of Decon Techn agai
	Base Option Period Number 4	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☒ Work Assignment
- ☐ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2): ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Lukas Oudejans	Branch/Mail Code:
(Signature) (Date)	Phone Number: 919-541-2973
	FAX Number:
Project Officer Name: Kevin Sudderth	Branch/Mail Code:
(Signature) (Date)	Phone Number: 919-541-3670
	FAX Number:
Other Agency Official Name	Branch/Mail Code:
(Signature) (Date)	Phone Number:
	FAX Number:
Contracting Official Name: William Yates	Branch/Mail Code:
William Yates 5-14-13	Phone Number: 513-487-2055
(Signature) (Date)	FAX Number:

STATEMENT OF WORK
Contract EP-C-09-027

PROJECT NUMBER C.2.3.3

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. TITLE

Evaluation of Decontamination Technologies against Radionuclides under Various Environmental Conditions

II. PERIOD OF PERFORMANCE

The period of performance for the tasks detailed in this Statement of Work (SOW) shall be from time of award until March 31, 2014.

III. SUMMARY OF OBJECTIVES

This work will evaluate the impact that environmental conditions may have on the ability of strippable coatings and/or decontamination gels to properly cure on a representative building material in the urban environment. Curing of these coatings and/or gels is critical in obtaining a high contaminant removal efficiency for targeted radionuclides and assures the easy removal of such coatings/gels from a surface. This work assignment (WA) will not assess the impact that these environmental conditions may have on the technology's decontamination efficacy (removal of radionuclides from a surface).

IV. BACKGROUND

In 2010, Federal, state, and local authorities participated in a 5-day homeland security exercise in Philadelphia, PA. This exercise, called Liberty RadEx was designed to test the country's capability to clean up and help communities recover from a radiological dispersal device (RDD) detonation. As part of this exercise, various decontamination technologies were demonstrated for the removal of radionuclides from building materials. One of these demonstrations involved the application of a strippable coating to wall and floor surfaces of the city's subway system. This method of decontamination had been previously investigated at a lab scale as a potential method for removal of radionuclides from an urban building surface. One of the observations made during Liberty RadEx was that the coating did not properly cure over an extended period of time (more than 24 hours) while the curing time stated by the manufacturer was 4-6 hours, depending on the environmental conditions. The failure to cure has been postulated to be due to the high relative humidity (RH) and low ventilation environment experienced during the demonstration.

V. TECHNICAL APPROACH

Details for the general technical approach can be found in Section VII. The general approach will be to use a modified glove box as was previously used for WAs 1-26 and 2-26 to establish controlled temperature, relative humidity (RH), and airflow conditions. Building coupons will be allowed to be in pseudo equilibrium with the controlled environmental conditions for 48 hours prior to the application of the decontamination coating or gel per manufacturer's recommendations. The curing time will be determined through measurement of the ability to successfully peel away the coating or gel from the surface. A first attempt would be made after the prescribed (shortest) curing time (per the manufacturer). If not successful, three additional attempts will be made at intervals for up to 24 hours after application.

VI. FACILITIES AND MATERIALS

All work on the project described in this statement of work shall be performed at the U.S. EPA's facilities located at 109 TW Alexander Dr, Research Triangle Park, NC. Decontamination testing is anticipated to be performed in a modified glove box currently present in H-210.

VII. TASKS

The contractor shall perform the following tasks as part of this work assignment.

TASK 1. DEVELOPMENT OF QUALITY ASSURANCE PROJECT PLAN (QAPP)

The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The contractor shall prepare the QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf and the NHSRC Quality Assurance (QA) requirement as defined in Attachment #2 to the SOW or based on the type of research that is being conducted.
A draft of the QAPP will be reviewed by the EPA Quality Assurance Manager. The contractor shall respond to comments to the draft QAPP from the EPA WAM and Quality Assurance Manager and submit a revised version of the QAPP for approval to the EPA Quality Assurance Manager.
The QAPP must be approved by the U.S. EPA in writing (e.g., signature on the approval page) prior to the start of any laboratory work. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

TASK 2. SETUP GLOVE BOX TEMPERATURE (T) AND RH CONTROL

The contractor shall prepare a modified glove box in which temperature, RH and air exchange can be controlled between 0 and 40 deg C and RH between 20 and 80% in combination with airflows of 1 air exchanges per hour or a reduced airflow. The contractor shall discuss with the EPA WAM if targeted temperature, RH, and airflow combinations cannot be maintained and propose modifications to the glove box. The EPA WAM may provide alternative environmental conditions. The contractor shall monitor and record airflow, T, and RH during the tests.

TASK 3. COUPON MANUFACTURING

The contractor shall prepare sufficient stainless steel (SS) and concrete coupons of 9" x 9" dimensions to complete the test matrix described under Task 4. Concrete coupons shall be prepared as per method to be specified by the WAM, similar to the methods used in previous EPA laboratory evaluations. Concrete coupons shall be allowed to age for at least 30 days. Temperature shall be controlled (73.5 ± 3.5 F (23 ± 2 °C)) and RH shall be monitored electronically (at least hourly) during this 30 days concrete curing period.

TASK 4. TEST MATRIX

The contractor shall measure the time to cure the strippable coating/gel on SS and concrete coupons under twelve environmental conditions consisting of three temperatures (selected within the 0-40 °C range), two RH values (20-80% range) and two air flows (one air exchange/hour and a reduced air exchange/hour). Each test point shall consist of three concrete coupons (two vertical, one horizontal) and one SS coupon. The EPA WAM will identify four decontamination technologies, (e.g. strippable coatings and/or gels) for evaluation of their curing time under all combinations of temperature, RH, and airflow (48 test points). In addition, the curing time shall also be measured for one set of coupons for each decontamination technology that has been pre-wetted and kept at a specific room temperature, high humidity condition. Details on the temperature and RH, amount of water spray, timing to achieve wetting shall be agreed upon with the EPA WAM. This yields 4 additional test points. Hence the total test matrix will consist of 52 measurements of the curing time.

The coating/gel shall be applied per manufacturer's instructions outside the modified glove box using a separate enclosure to satisfy health and safety concerns related to the application of the coating/gel. The contractor shall agree upon the selected application method (spray, brush, roller) with the EPA WAM. The emphasis will be on a realistic application that can be expanded to larger surface areas.

The contractor shall document findings in EPA approved laboratory notebooks as well as by digital photographs which shall depict the coating/gel on the coupon surface following (un)successful attempts to peel away this coating/gel.

TASK 5. TEST REPORT

The contractor shall prepare a test report (a draft version for EPA WAM review and approval followed by a revised draft for peer and QA review; and a final version) which shall include the test conditions, methods, quality assurance, and results of the tests conducted per the requirements of this SOW. The report shall also include a brief description of the decontamination technologies tested. The report shall conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPN 800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

VIII. DELIVERABLE SCHEDULE

On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, cumulative financial expenditures and cost and schedule variance.

The deliverables required are shown in Table 1.

Table 1: Deliverable Schedule.

Task Number	Deliverable	Due Date
	Biweekly research meetings	N/A
1	Draft QAPP Final QAPP	45 days after award of WA 14 days after receipt comments to draft from EPA WAM and QA manager
2	Modified glove box with T, RH and airflow	6/30/13
3	Coupons to conduct test matrix	6/30/13
4	Curing time of 4 decon coatings/gels at all test conditions; associated digital photographs	12/31/13
5	Draft report to WAM Revised draft report for QA and peer review Final report	1/15/14 2/1/14 3/15/14

IX. REPORTING REQUIREMENTS

- Data related to this project shall be stored on the US EPA server's DTRL shared drive;

- Transfer of project data shall occur at the conclusion of each experiment within the task. Detailed written summaries of experimental procedures and results shall be provided to the WAM within one week from completion of data analysis;
- Reporting results of Task 4 shall be in the form of spreadsheet(s) using MS Excel 2007 which will be reviewed by the EPA WAM and used for data reporting;
- All photographs and videos shall be properly documented by providing information on the test conditions under which they were taken.

NHSRC QUALITY ASSURANCE REQUIREMENTS FORM

Attachment 1 to the Statement of Work

I GENERAL INFORMATION

Title:	Evaluation of Decontamination Technologies against Radionuclides under Various Environmental Conditions	
Description:	This work will evaluate the impact that environmental conditions may have on the ability of strippable coatings and/or decontamination gels to properly cure on a representative building material in the urban environment. Curing of these coatings and/or gels is critical in obtaining a high contaminant removal efficiency for targeted radionuclides and assures the easy removal of such coatings/gels from a surface.	
Project ID:	C.2.3.3	
Status:	Original	
Number Ammended:		
QA Category:	III	
Action Type:	Extramural	
Peer Review Category:	III	
Security Classification:		
Project Type:	Applied Research	
QAPP Status 1:	Not Delivered	
Vehicle Status:	Existing Vehicle	
Vehicle Type:	Vehicle Number:	EP-C-09-027
	Work Assignment Number:	4-11
	Delivery/Task Order Number:	N/A
	Modification Number:	N/A
	Other:	N/A

*If you are processing an **IAG** or **CRADA**, the responsibility for QA must be negotiated within the agreement. The TLPs in consultation with the QAMs in the various organizations must agree on, and document, which organization will take the lead for QA, the names of the QAM and TLP from each organization, and the QA requirements that will be adhered to during the agreement. Include this info in the IAG/CRADA package.*

II SCOPE OF WORK

Yes — Does the Statement of Work contain the appropriate QA language?

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with the R-2 and R-5 and/or the attachments provided with the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf

Yes — Does this extramural action involve the collection, generation, use, and/or reporting of environmental data; the design, construction, and operation of environmental technologies; or development of software, models, or methods?

(If "No" then skip to Section IV, and sign the form.)

No — Will the SOW or any subsequent work assignments or task orders involve any cross-organizational efforts within EPA?

No — Has a QAPP already been approved for the activities specified in the SOW?

Yes — Is an applicable QAPP in the process of being prepared, revised, or approved by EPA personnel for future use by the contractor? (QA approval must be obtained before the contractor can start work.)

Provide the expected title for submission to QA staff for approval:

Evaluation of Decontamination Technologies under Various Environmental Conditions

Provide the approximate date for submission to QA staff for approval:

05/15/2013

III QA DOCUMENTATION OPTIONS

All documentation specified under "Other" must be defined in the NHSRC Quality Management Plan and be consistent with requirements defined in EPA Manual 5360 A1. For all items checked below, there must be adequate information in the SOW (or its appendices) for the offeror to develop this documentation. Where applicable, reference a specific section of the SOW. *(R-2 refers to EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, 03/20/01) and R-5 refers to EPA Requirements for Quality Assurance Project Plans (QA/R-5) (EPA/240/B-01/003, 03/20/01). Copies of these documents are available at http://www.epa.gov/quality/qa_docs.html.)*

After Award Documentation

Not Applicable	Documentation of an organization's Quality System. QMP developed in accordance with:
R2 and R5	Combined documentation of an organization's Quality System and application of QA and QC to the single project covered by the contract: Developed in accordance with:
Other	Documentation of the application of QA and QC activities to applicable project(s). Developed in accordance with:
	Explain: NHSRC QMP and Attachment 2 to this SOW
	Programmatic QA Project Plan with supplements for each specific project, developed in accordance with:
Not Applicable	Existing documentation of the application of QA and QC activities will be used:

IV SIGNATURE BLOCK

The signatures below verify that the Statement of Work (SOW) has been reviewed to ascertain the necessary QA and QC activities required to comply with EPA Order 5360.1 A2, that the COR understands these requirements, and that the COR will ensure that the quality requirements indicated on the previous pages of this form are incorporated into all associated SOWs. *(Sign/date below, obtain a concurrence signature from the QA Staff, and submit the form along with the other extramural action documentation.)*

Lukas Oudejans NHSRC-DCMD Technical Lead Person	03/01/2013 Date	NHSRC-IO QA Staff Member	03/01/2013 Date

(from Appendix B of the NHSRC QMP)

An applied research project is a study to demonstrate the performance of technologies under defined conditions. These studies are often pilot- or field-scale. The following requirements should be addressed as applicable.

SECTION 0.0, APPROVAL BY PROJECT PARTICIPANTS

The EPA Technical Lead Person (TLP) shall be responsible for obtaining signatures of appropriate project participants on the signature page of the QA plan, documenting agreement to project objectives and the approach for evaluating these objectives.

A distribution list shall be provided to facilitate the distribution of the most recent current version of the QAPP to all the principal project participants.

SECTION 1.0, PROJECT DESCRIPTION AND OBJECTIVES

1.1 The purpose of study shall be clearly stated.

1.2 The process, site, facility, and/or environmental system to be tested shall be described.

1.3 Project objectives shall be clearly stated and identified as primary or non-primary.

SECTION 2.0, PROJECT ORGANIZATION

2.1 Key points of contact for each organization involved in the project shall be identified.

2.2 All QA Managers and their relationship in the organizations (*i.e.*, location within each organization) shall be identified with evidence that the QA Manager is independent of project management.

2.3 Responsibilities of all other project participants and their relationship to other project participants shall be identified, meaning that organizations responsible for planning, coordination, sample collection, sample custody, measurements (*i.e.*, analytical, physical, and process), data reduction, data validation, and report preparation shall be clearly identified.

SECTION 3.0, EXPERIMENTAL APPROACH

3.1 The general approach and the test conditions for each experimental phase shall be provided. The statistical methods that will be used to evaluate the data (*i.e.*, ANOVA, or summary statistics) should be identified.

(NOTE: As deemed appropriate to the project by the TLP, the information requested in Sections 3.2, 3.3, and 3.4 may be presented here or in Section 4; the information requested in Sections 3.5 may be presented here or in Section 5; and the information requested in Sections 3.6 may be presented here or in Section 7.)

3.2 The sampling strategy shall be included and evidence must be presented to demonstrate that the strategy is appropriate for meeting primary project objectives, *i.e.*, a description of the statistical method or scientific rationale used to select sample sites and number of samples shall be provided.

3.3 Sampling/monitoring points for all measurements (*i.e.*, including locations and access points) shall be identified.

3.4 The frequency of sampling/monitoring events, as well as the numbers for each sample type and/or location shall be provided, including QC and reserve samples.

3.5 All measurements (*i.e.*, analytical [chemical, microbiological, assays], physical, and process) shall be identified for each sample type or process, and project-specific target analytes shall be listed and classified as critical or noncritical in the QAPP.

3.6 The planned approach (statistical and/or non-statistical) for evaluating project objectives shall be included.

SECTION 4.0, SAMPLING PROCEDURES

4.1 Whenever applicable, the method used to establish steady-state conditions shall be described.

4.2 Known site_specific factors that may affect sampling/monitoring procedures shall be described.

4.3 Any site preparation needed prior to sampling/monitoring shall be described.

4.4 Each sampling/monitoring procedure to be used shall be discussed or referenced. If compositing or splitting samples, those procedures shall be described.

4.5 For samples requiring a split sample for either QA/QC purposes or for shipment to a different laboratory, the QAPP shall identify who is responsible for splitting samples, and where the splitting is performed (*e.g.*, field versus lab).

4.6 If sampling/monitoring equipment is used to collect critical measurement data (*i.e.*, used to calculate the final concentration of a critical parameter), the QAPP shall describe how the sampling equipment is calibrated, the frequency at which it is calibrated, and the acceptance criteria for calibration or calibration verification, as appropriate.

4.7 If sampling/monitoring equipment is used to collect critical measurement data, the QAPP shall describe how cross-contamination between samples is avoided.

4.8 The QAPP shall include a discussion of the procedures to be used to assure that representative samples are collected.

4.9 A list of sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis, shall be specified.

4.10 Containers used for sample collection, transport, and storage for each sample type shall be described.

4.11 Describe how samples are uniquely identified.

4.12 Sample preservation methods (*e.g.*, refrigeration, acidification, *etc.*), including specific reagents, equipment, and supplies required for sample preservation shall be described.

4.13 Holding time requirements shall be noted.

4.14 Procedures for packing and shipping samples shall be described.

4.15 Procedures to maintain chain_of_custody (*e.g.*, custody seals, records) during transfer from the field to the laboratory, in the laboratory, and among contractors and subcontractors shall be described to ensure that sample integrity is maintained.

4.16 Sample archival requirements for each relevant organization shall be provided.

SECTION 5.0, TESTING AND MEASUREMENT PROTOCOLS

5.1 Each measurement method to be used shall be described in detail or referenced. Modifications to EPA_approved or similarly validated methods shall be specified.

5.2 For unproven methods, verification data applicable to expected matrices shall be included in the QAPP meaning the QAPP shall provide evidence that the proposed method is capable of achieving the desired performance.

5.3 For measurements which require a calibrated system, the QAPP shall include specific calibration procedures applicable to each project target analyte, and the procedures for verifying both initial and continuing calibrations (including frequency and acceptance criteria, and corrective actions to be performed if acceptance criteria are not met).

SECTION 6.0, QA/QC CHECKS

6.1 At a minimum, the QAPP shall include quantitative acceptance criteria for QA objectives associated with accuracy, precision, detection limits, and completeness for critical measurements (process, physical, and analytical, as applicable) for each matrix.

6.2 Any additional project-specific QA objectives shall be presented, including acceptance criteria. This includes items such as mass balance requirements.

6.3 The specific procedures used to assess all identified QA objectives shall be fully described.

6.4 The QAPP shall list and define all other QC checks and/or procedures (*e.g.*, blanks, surrogates, controls, *etc.*) used for the project, both field and laboratory.

6.5 For each specified QC check or procedure, required frequencies, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met shall be included.

SECTION 7.0, DATA REPORTING, DATA REDUCTION, AND DATA VALIDATION

7.1 The reporting requirements (*e.g.*, units, reporting method [wet or dry]) for each measurement and matrix shall be identified.

7.2 The deliverables expected from each organization responsible for field and laboratory activities shall be listed.

7.3 Data reduction procedures specific to the project, and also specific to each organization, shall be summarized.

7.4 Data validation procedures specific to each organization used to ensure the reporting of accurate project data to internal and external clients shall be summarized.

7.5 Data storage requirements for each organization shall be provided.

7.6 The product document that will be prepared for the project shall be specified (*e.g.*, journal article, final report, *etc.*). The contents of this document can be referenced to a NHSRC or program-specific QMP, if appropriate.

SECTION 8.0, ASSESSMENTS

8.1 The QAPP shall identify all scheduled audits (*i.e.*, both technical system audits [TSAs] and performance evaluations [PEs]) to be

performed, who will perform these audits, and who will receive the audit reports.

8.2 The QAPP shall provide procedures that are to be followed that will ensure that necessary corrective actions will be performed.

8.3 The responsible party(-ies) for implementing corrective actions shall be identified.

SECTION 9.0, REFERENCES

References shall be provided either in the body of the text as footnotes or in a separate section.

Attachment # 2

NHSRC QA
To the Statement of Work
Requirements/Definitions List

EPAs Quality System Website: http://www.epa.gov/quality
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html
EPA's Quality System Website: http://www.epa.gov/quality/qs-docs/r5-final.pdf

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

NHSRC QA Requirements/Definitions List
Category Level Designations (determines the level of QA required):

☐ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP: QAPP** requirements for the specific project type (see below).

☐ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP QAPP** requirements for the specific project type (see below).

Project Types:

These outlines of NHSRC's QAPP Requirements for various project types, from Appendix B of the NHSRC QMP (except where otherwise noted), are condensed from typically applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These lists and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

Applied Research Project - pertains to a study performed to generate data to demonstrate the performance of accepted processes

☐ or technologies under defined conditions. These studies are often pilot- or field-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Applied Research Projects" from Appendix B of the NHSRC QMP.

☐ **Basic Research Project** - pertains to a study performed to generate data used to evaluate unproven theories, processes, or technologies. These studies are often bench-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Basic Research Projects" from Appendix B of the NHSRC QMP.

☐ **Design, Construction, and/or Operation of Environmental Technology Project** - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" G-11, at http://www.epa.gov/quality/QS-docs/g11-final-05.pdf. For additional information, you may refer to Part C of "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology," ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995.

☐ **Geospatial Data Quality Assurance Project** - pertains to data collection; data processing and analysis; and data validation of geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" G-5S at http://www.epa.gov/quality/QS-docs/g5g-final-05.pdf.

☐ **Method Development Project** - pertains to situations where there is no existing standard method, or a standard method needs to be significantly modified for a specific application. The QAPP shall address all requirements listed in "QAPP Requirements for Method Development Projects" from Appendix B of the NHSRC QMP.

☐ **Model Development Project** - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" G-5M at http://www.epa.gov/quality/QS-docs/g5m-final.pdf.

☐ **Sampling and Analysis Project** - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information. The QAPP shall address all requirements listed in "QAPP Requirements for Sampling and Analysis Projects" from Appendix B of the NHSRC QMP.

☐ **Secondary Data Project** - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. The QAPP shall address all requirements listed in "QAPP Requirements for Secondary Data Projects" from Appendix B of the NHSRC QMP.

☐ **Software Development and Data Management Project** - pertains to software development, software/hardware systems development, database design and maintenance, data validation and verification systems. The QAPP shall address all requirements listed in "QAPP Requirements for Software Development Projects" from Appendix B of the NHSRC QMP.

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r2-final.pdf.

R-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r5-final.pdf.

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Technical Lead Person (TLP) - This person is technically responsible for the project. For extramural contract work, the TLP is typically the contracting officer's representative (COR). For intramural work, the TLP is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
NRMRL	National Risk Management Research Laboratory	QAM	Quality Assurance Manager
QA ID	Quality Assurance Identification	QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan	SOW	Statement of Work
QS	Quality System	CRADA	Cooperative Research & Development Agreement
TLP	Technical Lead Person		

Attachment #2 to the Statement of Work
Revision 1. March 2006
NHSRC 06/02

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-12

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base X Option Period Number	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Lukas Oudejans (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-2973 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 5-14-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK
Contract EP-C-09-027

PROJECT NUMBER C.2.3.2

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. TITLE

Interaction of Fumigation with Realistic Surfaces from Subway System

II. PERIOD OF PERFORMANCE

The period of performance for the tasks detailed in this Statement of Work (SOW) shall be from time of award until March 31, 2014.

III. SUMMARY OF OBJECTIVES

This work will evaluate the impact dirt and grime, as present on unpainted subway concrete, have on fumigation conditions, consider whether these realistic surfaces will impact the procedures for sampling of *Bacillus anthracis* (surrogate) spores and determine the impact the dirt and grime have on the efficiency of two efficacious fumigation technologies against B. *anthracis* (surrogate) spores. All tests will be conducted at a glove-box scale.

IV. BACKGROUND

In the event of a chemical/biological incident in a transportation hub like a subway system, remediation may require the use of volumetric decontamination approaches such as fumigation as an effective decontamination method. Previous (NHSRC) studies have shown that fumigants like chlorine dioxide and hydrogen peroxide vapors can be highly efficacious if applied under the specific environmental (temperature and relative humidity) conditions. It is, however, unclear what the impact is on the efficacy of dirt and grime on these realistic building materials. Such presence may result in change in sporicidal activity of the fumigant and may require changes in operational fumigation conditions ("material demand") to reach remediation goals.

V. TECHNICAL APPROACH

Details for the general technical approach can be found in Section VIII but the overall technical direction follows approaches established under previous work assignments related to fumigation

efforts of building materials contaminated with B. *anthracis* surrogate spores with chlorine dioxide or hydrogen peroxide vapor. For each test, the effort shall include recovery of viable spores from the concrete material. Each test point will consist of three test coupons and three positive controls that are contaminated but are not to be fumigated. Test and analytical methods shall be adopted from past or on-going efforts in consultation with the EPA work assignment manager (WAM).

This work assignment covers only the efforts related to the decontamination tests themselves. All microbiological preparation and analyses will be covered under the parallel on-site Biolab work assignment on this contract.

VI. AFFORDABILITY

Decontamination testing is expected to be labor intensive. In comparison to the labor costs, only a minimal amount of expendable materials are required to be purchased by the contractor.

VII. FACILITIES AND MATERIALS

All work on this project described in this statement of work shall be performed at the U.S. EPA's facilities located at 109 T.W. Alexander Dr, Research Triangle Park, NC. Decontamination testing is anticipated to be performed in glove boxes currently located in H-122A.

VIII. TASKS

The contractor shall perform the following tasks as part of this work assignment. All microbiological preparation and analyses will be covered under the parallel on-site Biolab work assignment on this contract.

TASK 1. DEVELOPMENT OF A QUALITY ASSURANCE PROJECT PLAN

The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2.
The contractor shall prepare a Quality Assurance Project Plan (QAPP) in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf and the NHSRC Quality Assurance (QA) requirement as defined in Attachment #2 to the SOW or based on the type of research that is being conducted. A draft of the QAPP will be reviewed by the EPA Quality Assurance Manager. The contractor shall respond to comments to the draft QAPP from the EPA WAM and Quality Assurance Manager and submit a revised version of the QAPP for approval to the EPA Quality Assurance Manager. The QAPP must be approved by the U.S. EPA in writing (e.g., signature on the approval page) prior to the start of any laboratory work. Additional information

related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

TASK 2. SUBWAY SURFACE SAMPLE PREPARATION

The concrete subway samples are highly irregular in shape and size, including a large variety in thickness. The contractor shall assess the inventory of concrete samples as provided by US EPA. Irregular shaped coupons shall be cut into square coupons in consultation with the EPA WAM. Most of the coupons (exact number to be determined in consultation with EPA WAM) shall undergo a cleaning procedure which will be provided by the EPA WAM. This procedure is derived from the procedures used by New York City (NYC) Metropolitan Transportation Authority (MTA) for cleaning in subways.

TASK 3. SUBWAY MATERIAL CHARACTERIZATION

The contractor shall characterize representative concrete coupons for properties such as porosity, particle and bulk density, composition (% quartz, illite clay and other minerals), and organic carbon content. This characterization shall occur for a concrete sample received "as is" and one sample of near equal size that has been cleaned using the NYC MTA cleaning method.

TASK 4. MODIFY AEROSOL DEPOSITION OF B. *ANTHRACIS* SURROGATE SPORES

A previously designed method for deposition of bioaerosols onto 14"×14" coupons (effective deposition area 12"×12") shall be evaluated on its ability to deliver reproducible amounts of spores on predetermined locations from the center of the coupon for targeted 2" diameter surfaces areas. The contractor shall evaluate whether reproducible aerosol deposition occurs such that simultaneous dosing of (at least) six (concrete) coupons (anticipated surface areas of 2"×2") is possible using a single deposition procedure. Such assessment shall occur in triplicate (using stainless steel as the surface material) and shall be conducted at two spore loadings to be established by the EPA WAM during the writing of the QAPP. (Wetted) wipe sampling from the individual surfaces shall be used to quantify the number of spores deposited.

TASK 5. SURFACE SAMPLING

The contractor shall conduct an experiment that will determine the sampling method of B. *anthracis* surrogate spores from the provided subway surfaces. The contractor shall determine the recovered number of spores following aerosol deposition of B. *anthracis* surrogate spores using vacuum sock sampling, sponge wipe sampling, and using gauze sampling. Results from this test will determine the appropriate sampling method of the coupons under Task 3.

TASK 6. DECONTAMINATION TESTS

The contractor shall expect to conduct up to six fumigation experiments using chlorine dioxide gas and up to six fumigation experiments using hydrogen peroxide vapor. An adaptive testing approach shall be used in which testing results will be used to modify subsequent testing / fumigation conditions. All experiments shall be conducted using a small scale chamber such as a modified glove box. Initial concentrations and contact times will be selected in consultation with the EPA WAM during the writing of the QAPP. For each test point, three replicates shall be decontaminated while three other coupons shall be used for positive controls. Each test point should include one laboratory blank (no inoculation, no fumigation) and one procedural blank (fumigated with no inoculation). The contractor shall determine the efficacy (log reduction) of all targeted fumigation conditions. The contractor shall provide a qualitative assessment of the impacts that the two selected fumigation technologies have on the coupon materials. Digital photographs shall be made to support these observations.

TASK 7. TEST REPORT

The contractor shall prepare a test report (a draft version for EPA WAM review and approval followed by a revised draft for peer and QA review; and a final version) which shall include the test conditions, methods, quality assurance, and results of the tests conducted per the requirements of this SOW. The report shall also include a brief description of the decontamination technologies tested. The report shall conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPN 800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

IX. DELIVERABLE SCHEDULE

On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, cumulative financial expenditures and cost and schedule variance.

The deliverables in the form of completed data sheets are shown in Table 1.

Table 1: Deliverable Schedule.

Task Number	Deliverable	Due Date
	Biweekly research meetings	N/A
1	Draft version of QAPP	45 days from award of WA
	Final version of QAPP	14 days after receipt of comments from EPA QA Manager and EPA WAM
2	Concrete samples	6/1/2013
3	Concrete characterization	7/1/2013
4	Redesigned aerosol deposition method	7/1/2013
5	Recoveries using three sampling methods	7/31/2013
6	Efficacy data for both fumigation methods	10/31/2013
7	Draft test report to EPA WAM	12/31/2013
	Final test report	2/14/2014

X. REPORTING REQUIREMENTS

- Data related to this project shall be stored on the US EPA server's DTRL shared drive;
- Reporting sheets using MS Excel 2007 shall be developed by the contractor, reviewed by the EPA WAM and used for intermediate data reporting;
- All photographs and videos shall be properly documented by providing information on the test conditions under which they were taken.

NHSRC QUALITY ASSURANCE REQUIREMENTS FORM

Attachment 1 to the Statement of Work

I GENERAL INFORMATION

Title:	Interaction of Fumigation with Realistic Surfaces from Subway System	
Description:	This work will evaluate the impact dirt and grime, as present on unpainted subway concrete, have on fumigation conditions, consider whether these realistic surfaces will impact the procedures for sampling of Bacillus anthracis (surrogate) spores and determine the impact the dirt and grime have on the efficiency of two efficacious fumigation technologies against B. anthracis (surrogate) spores.	
Project ID:	C.2.3.2	
Status:	Original	
Number Ammended:		
QA Category:	III	
Action Type:	Extramural	
Peer Review Category:	III	
Security Classification:	Unclassified	
Project Type:	Applied Research	
QAPP Status 1:	Not Delivered	
Vehicle Status:	Existing Vehicle	
Vehicle Type:	Vehicle Number:	EP-C-09-027
	Work Assignment Number:	4-12
	Delivery/Task Order Number:	N/A
	Modification Number:	N/A
	Other:	N/A

*If you are processing an **IAG** or **CRADA**, the responsibility for QA must be negotiated within the agreement. The TLPs in consultation with the QAMs in the various organizations must agree on, and document, which organization will take the lead for QA, the names of the QAM and TLP from each organization, and the QA requirements that will be adhered to during the agreement. Include this info in the IAG/CRADA package.*

II SCOPE OF WORK

Yes — Does the Statement of Work contain the appropriate QA language?

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with the R-2 and R-5 and/or the attachments provided with the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf

Yes — Does this extramural action involve the collection, generation, use, and/or reporting of environmental data; the design, construction, and operation of environmental technologies; or development of software, models, or methods?

(If "No" then skip to Section IV, and sign the form.)

No — Will the SOW or any subsequent work assignments or task orders involve any cross-organizational efforts within EPA?

No Has a QAPP already been approved for the activities specified in the SOW?

Yes Is an applicable QAPP in the process of being prepared, revised, or approved by EPA personnel for future use by the contractor? (QA approval must be obtained before the contractor can start work.)

Provide the expected title for submission to QA staff for approval:

Interaction of Fumigation with Realistic Surfaces from Subway System

Provide the approximate date for submission to QA staff for approval:

05/15/2013

III QA DOCUMENTATION OPTIONS

All documentation specified under "Other" must be defined in the NHSRC Quality Management Plan and be consistent with requirements defined in EPA Manual 5360 A1. For all items checked below, there must be adequate information in the SOW (or its appendices) for the offeror to develop this documentation. Where applicable, reference a specific section of the SOW. *(R-2 refers to EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, 03/20/01) and R-5 refers to EPA Requirements for Quality Assurance Project Plans (QA/R-5) (EPA/240/B-01/003, 03/20/01). Copies of these documents are available at http://www.epa.gov/quality/qa_docs.html.)*

After Award Documentation

Not Applicable	Documentation of an organization's Quality System. QMP developed in accordance with:
R2 and R5	Combined documentation of an organization's Quality System and application of QA and QC to the single project covered by the contract: Developed in accordance with:
Other	**Documentation of the application of QA and QC activities to applicable project(s). Developed in accordance with:**
	Explain: NHSRC QMP and Attachment 2 to SOW
	Programmatic QA Project Plan with supplements for each specific project, developed in accordance with:
Not Applicable	**Existing documentation of the application of QA and QC activities will be used:**

IV SIGNATURE BLOCK

The signatures below verify that the Statement of Work (SOW) has been reviewed to ascertain the necessary QA and QC activities required to comply with EPA Order 5360.1 A2, that the COR understands these requirements, and that the COR will ensure that the quality requirements indicated on the previous pages of this form are incorporated into all associated SOWs. *(Sign/date below, obtain a concurrence signature from the QA Staff, and submit the form along with the other extramural action documentation.)*

Lukas Oudejans 2/28/2013		Ramona Sherman 02/28/13	
Lukas Oudejans NHSRC-DCMD Technical Lead Person	02/27/2013 Date	NHSRC-IO QA Staff Member	02/27/2013 Date

QAPP REQUIREMENTS FOR APPLIED RESEARCH PROJECTS

(from Appendix B of the NHSRC QMP)

An applied research project is a study to demonstrate the performance of technologies under defined conditions. These studies are often pilot- or field-scale. The following requirements should be addressed as applicable.

SECTION 0.0, APPROVAL BY PROJECT PARTICIPANTS

The EPA Technical Lead Person (TLP) shall be responsible for obtaining signatures of appropriate project participants on the signature page of the QA plan, documenting agreement to project objectives and the approach for evaluating these objectives.

A distribution list shall be provided to facilitate the distribution of the most recent current version of the QAPP to all the principal project participants.

SECTION 1.0, PROJECT DESCRIPTION AND OBJECTIVES

1.1 The purpose of study shall be clearly stated.

1.2 The process, site, facility, and/or environmental system to be tested shall be described.

1.3 Project objectives shall be clearly stated and identified as primary or non-primary.

SECTION 2.0, PROJECT ORGANIZATION

2.1 Key points of contact for each organization involved in the project shall be identified.

2.2 All QA Managers and their relationship in the organizations (*i.e.*, location within each organization) shall be identified with evidence that the QA Manager is independent of project management.

2.3 Responsibilities of all other project participants and their relationship to other project participants shall be identified, meaning that organizations responsible for planning, coordination, sample collection, sample custody, measurements (*i.e.*, analytical, physical, and process), data reduction, data validation, and report preparation shall be clearly identified.

SECTION 3.0, EXPERIMENTAL APPROACH

3.1 The general approach and the test conditions for each experimental phase shall be provided. The statistical methods that will be used to evaluate the data (*i.e.*, ANOVA, or summary statistics) should be identified.

(NOTE: As deemed appropriate to the project by the TLP, the information requested in Sections 3.2, 3.3, and 3.4 may be presented here or in Section 4; the information requested in Sections 3.5 may be presented here or in Section 5; and the information requested in Sections 3.6 may be presented here or in Section 7.)

3.2 The sampling strategy shall be included and evidence must be presented to demonstrate that the strategy is appropriate for meeting primary project objectives, *i.e.*, a description of the statistical method or scientific rationale used to select sample sites and number of samples shall be provided.

3.3 Sampling/monitoring points for all measurements (*i.e.*, including locations and access points) shall be identified.

3.4 The frequency of sampling/monitoring events, as well as the numbers for each sample type and/or location shall be provided, including QC and reserve samples.

3.5 All measurements (*i.e.*, analytical [chemical, microbiological, assays], physical, and process) shall be identified for each sample type or process, and project-specific target analytes shall be listed and classified as critical or noncritical in the QAPP.

3.6 The planned approach (statistical and/or non-statistical) for evaluating project objectives shall be included.

SECTION 4.0, SAMPLING PROCEDURES

4.1 Whenever applicable, the method used to establish steady-state conditions shall be described.

4.2 Known site_specific factors that may affect sampling/monitoring procedures shall be described.

4.3 Any site preparation needed prior to sampling/monitoring shall be described.

4.4 Each sampling/monitoring procedure to be used shall be discussed or referenced. If compositing or splitting samples, those procedures shall be described.

4.5 For samples requiring a split sample for either QA/QC purposes or for shipment to a different laboratory, the QAPP shall identify who is responsible for splitting samples, and where the splitting is performed (*e.g.*, field versus lab).

4.6 If sampling/monitoring equipment is used to collect critical measurement data (*i.e.*, used to calculate the final concentration of a critical parameter), the QAPP shall describe how the sampling equipment is calibrated, the frequency at which it is calibrated, and the acceptance criteria for calibration or calibration verification, as appropriate.

4.7 If sampling/monitoring equipment is used to collect critical measurement data, the QAPP shall describe how cross-contamination

between samples is avoided.

4.8 The QAPP shall include a discussion of the procedures to be used to assure that representative samples are collected.

4.9 A list of sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis, shall be specified.

4.10 Containers used for sample collection, transport, and storage for each sample type shall be described.

4.11 Describe how samples are uniquely identified.

4.12 Sample preservation methods (*e.g.*, refrigeration, acidification, *etc.*), including specific reagents, equipment, and supplies required for sample preservation shall be described.

4.13 Holding time requirements shall be noted.

4.14 Procedures for packing and shipping samples shall be described.

4.15 Procedures to maintain chain_of_custody (*e.g.*, custody seals, records) during transfer from the field to the laboratory, in the laboratory, and among contractors and subcontractors shall be described to ensure that sample integrity is maintained.

4.16 Sample archival requirements for each relevant organization shall be provided.

SECTION 5.0, TESTING AND MEASUREMENT PROTOCOLS

5.1 Each measurement method to be used shall be described in detail or referenced. Modifications to EPA_approved or similarly validated methods shall be specified.

5.2 For unproven methods, verification data applicable to expected matrices shall be included in the QAPP meaning the QAPP shall provide evidence that the proposed method is capable of achieving the desired performance.

5.3 For measurements which require a calibrated system, the QAPP shall include specific calibration procedures applicable to each project target analyte, and the procedures for verifying both initial and continuing calibrations (including frequency and acceptance criteria, and corrective actions to be performed if acceptance criteria are not met).

SECTION 6.0, QA/QC CHECKS

6.1 At a minimum, the QAPP shall include quantitative acceptance criteria for QA objectives associated with accuracy, precision, detection limits, and completeness for critical measurements (process, physical, and analytical, as applicable) for each matrix.

6.2 Any additional project-specific QA objectives shall be presented, including acceptance criteria. This includes items such as mass balance requirements.

6.3 The specific procedures used to assess all identified QA objectives shall be fully described.

6.4 The QAPP shall list and define all other QC checks and/or procedures (*e.g.*, blanks, surrogates, controls, *etc.*) used for the project, both field and laboratory.

6.5 For each specified QC check or procedure, required frequencies, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met shall be included.

SECTION 7.0, DATA REPORTING, DATA REDUCTION, AND DATA VALIDATION

7.1 The reporting requirements (*e.g.*, units, reporting method [wet or dry]) for each measurement and matrix shall be identified.

7.2 The deliverables expected from each organization responsible for field and laboratory activities shall be listed.

7.3 Data reduction procedures specific to the project, and also specific to each organization, shall be summarized.

7.4 Data validation procedures specific to each organization used to ensure the reporting of accurate project data to internal and external clients shall be summarized.

7.5 Data storage requirements for each organization shall be provided.

7.6 The product document that will be prepared for the project shall be specified (*e.g.*, journal article, final report, *etc.*). The contents of this document can be referenced to a NHSRC or program-specific QMP, if appropriate.

SECTION 8.0, ASSESSMENTS

8.1 The QAPP shall identify all scheduled audits (*i.e.*, both technical system audits [TSAs] and performance evaluations [PEs]) to be performed, who will perform these audits, and who will receive the audit reports.

8.2 The QAPP shall provide procedures that are to be followed that will ensure that necessary corrective actions will be performed.

8.3 The responsible party(-ies) for implementing corrective actions shall be identified.

SECTION 9.0, REFERENCES

References shall be provided either in the body of the text as footnotes or in a separate section.

Attachment # 2

NHSRC QA
To the Statement of Work
Requirements/Definitions List

EPAs Quality System Website: http://www.epa.gov/quality
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html
EPA's Quality System Website: http://www.epa.gov/quality/qs-docs/r5-final.pdf

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

NHSRC QA Requirements/Definitions List
Category Level Designations (determines the level of QA required):

☐ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP: QAPP** requirements for the specific project type (see below).

☐ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP QAPP** requirements for the specific project type (see below).

Project Types:

These outlines of NHSRC's QAPP Requirements for various project types, from Appendix B of the NHSRC QMP (except where otherwise noted), are condensed from typically applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These lists and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

☐ **Applied Research Project** - pertains to a study performed to generate data to demonstrate the performance of accepted processes or technologies under defined conditions. These studies are often pilot- or field-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Applied Research Projects" from Appendix B of the NHSRC QMP.

☐ **Basic Research Project** - pertains to a study performed to generate data used to evaluate unproven theories, processes, or technologies. These studies are often bench-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Basic Research Projects" from Appendix B of the NHSRC QMP.

☐ **Design, Construction, and/or Operation of Environmental Technology Project** - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" G-11, at http://www.epa.gov/quality/QS-docs/g11-final-05.pdf. For additional information, you may refer to Part C of "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology," ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995.

☐ **Geospatial Data Quality Assurance Project** - pertains to data collection; data processing and analysis; and data validation of geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" G-5S at http://www.epa.gov/quality/QS-docs/g5g-final-05.pdf.

☐ **Method Development Project** - pertains to situations where there is no existing standard method, or a standard method needs to be significantly modified for a specific application. The QAPP shall address all requirements listed in "QAPP Requirements for Method Development Projects" from Appendix B of the NHSRC QMP.

☐ **Model Development Project** - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" G-5M at http://www.epa.gov/quality/QS-docs/g5m-final.pdf.

☐ **Sampling and Analysis Project** - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information. The QAPP shall address all requirements listed in "QAPP Requirements for Sampling and Analysis Projects" from Appendix B of the NHSRC QMP.

☐ **Secondary Data Project** - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. The QAPP shall address all requirements listed in "QAPP Requirements for Secondary Data Projects" from Appendix B of the NHSRC QMP.

☐ **Software Development and Data Management Project** - pertains to software development, software/hardware systems development, database design and maintenance, data validation and verification systems. The QAPP shall address all requirements listed in "QAPP Requirements for Software Development Projects" from Appendix B of the NHSRC QMP.

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality

assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r2-final.pdf.

R-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r5-final.pdf.

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Technical Lead Person (TLP) - This person is technically responsible for the project. For extramural contract work, the TLP is typically the contracting officer's representative (COR). For intramural work, the TLP is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
NRMRL	National Risk Management Research Laboratory	QAM	Quality Assurance Manager
QA ID	Quality Assurance Identification	QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan	SOW	Statement of Work
QS	Quality System	CRADA	Cooperative Research & Development Agreement
TLP	Technical Lead Person		

Attachment #2 to the Statement of Work
Revision 1. March 2006
NHSRC 06/02

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-13

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base X Option Period Number	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Worth Calfee (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7600 FAX Number: 919-541-0496
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates (Signature) 3/21/13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Biocontaminant Laboratory Technical Support
Statement of Work

Project# C.2.2.1.9
(OMIS DCMD 4.12)
(APPCD ON-SITE CONTRACT EP-C-09-027, WA 4-13)

TABLE OF CONTENTS

I. TITLE: Biocontaminant Laboratory Technical Support

II. PERIOD OF PERFORMANCE

The period of performance for this work assignment shall be from the April 1, 2013 – March 31, 2014.

III. SUMMARY OF OBJECTIVES

The proposed work will provide microbiological support to on-going and planned research efforts conducted by EPA's National Homeland Security Research Center (NHSRC). Such support includes, but is not limited to, growth and maintenance of biological cultures and stocks; preparation of media and reagents used in microbiological analyses; organization, inventory, and upkeep of laboratory notebooks, glassware, equipment, and supplies; preparation of spore suspensions of various surrogate biological agents; sterilization of test materials and instruments; inoculation of coupons and materials used in decontamination studies; creation of new and update of existing MOPs (define acronym MOP) used in decontamination research; and numerous laboratory analyses used to determine survivorship of biological agents in decontamination, disposal, and containment studies.

IV. RELEVANCE

The results of the work conducted under this WA study will be used to support other research projects related to the selection and application of candidate decontamination technologies for buildings or areas (i.e., indoor or outdoor scenarios) contaminated with biological warfare agents. Data generated through this work will also support containment and disposal-related homeland security research. The results of these works will be made available through published reports, journal papers, and conference abstracts and presentations.

V. BACKGROUND

Following a bioterrorist attack, materials contaminated with biological agent pose significant health threats. The EPA's NHSRC conducts research to develop methods and technologies able to rapidly and cost-effectively remediate areas affected by a bioterrorism attack. Tasks performed under this work assignment support such research.

VI. SCOPE

The objective of this work is to provide high-quality microbiological support to homeland security-related decontamination, disposal, and containment research projects. Most if not all of these projects being supported will be conducted via WAs under this contract as well. Such projects often require material coupons spiked with surrogate organisms as well as survivability analyses of coupons following treatment. For these tasks, laboratory technicians trained in aseptic techniques and general microbiological laboratory procedures shall carry out biological analyses on samples generated during decontamination, disposal, and containment research. Data generated and collected during these analyses shall be properly recorded and shared in a timely manner. In

addition, a significant amount of laboratory management is needed to sustain an efficient workflow.

VII. TECHNICAL APPROACH

Microbiological efforts will generally include the following activities: (1) preparation (e.g., sterilization) and analysis of coupons using various types of materials and biologicals (2) analysis of decontamination and containment research samples (3) developing standard diagnostic protocols for several decontamination technologies to assess microbial survivability (4) preparation of microbiological media and reagents (5) and timely reporting of data . Note: The treatment studies themselves (e.g., fumigation at specified conditions, rotary kiln operation, deposition studies, etc) will be conducted via the use of other WAs performed under this contract. The general purpose of this WA is to provide microbiological support for those other WAs. Additionally, projects may be initiated by the WAM in order to fully utilize personnel during periods of low workload.

The specific microbiological laboratory efforts will include (but not limited to) such things as the following:

(1) Spiking of coupons with the appropriate controls for any NHSRC decontamination, disposal, and/or containment projects.
(2) Growth and maintenance of the bacterial cultures used for the standard diagnostic protocols
(3) Perform the survivability analyses as required by the projects mentioned above.
(4) Develop standard diagnostic protocols if necessary to assess microbial survivability
(5) Prepare, sterilize, dispense, and confirm sterility of microbiological media.
(6) Properly destroy and dispose of contaminated/spiked testing materials
(7) Maintain laboratory notebooks, supplies, reagents, microbiological media, equipment, and certificates.
(8) Operation and maintenance of in–house microbiological instruments and equipment.
(9) Evaluate data acquired and prepare reports documenting the results obtained, and the quality of the results. The reports shall include any tables, charts, graphs, drawings, or appendices necessary to fully explain the experiments performed, shall clearly document the results, and shall support the quality of data included.
(10) Provide the raw data to the WAM of this WA, and as well to the WAM of the project being supported. Data shall be provided electronically in a timely manner (as soon as available, not greater than 2 days following completion of the analysis generating said data) when requested or as indicated by a QAPP. All data sheets shall be legible, and contain all pertinent identifier information (i.e., technician name, date, number of WA being supported, analyses performed, organism, etc.)
(11) The contractor shall comply with all requirements as delineated on the QA requirement as defined in Attachment #1 to the SOW.

VIII. FACILITIES AND MATERIALS

All tasks described in this SOW shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr. The Biocontaminant Laboratory located in E390 is a BSL-2 facility equipped with biological safety cabinets, microbial dynamic and static growth test chambers and bioaerosols test chambers as well as standard microbiological equipment such as steam autoclaves; incubators; refrigerators; centrifuges; light, fluorescent, and phase contrast microscopes, colony counters; and analytical balances.

Field Code Ch

IX. TASKS

To achieve the desired objective of this effort, the Microbiological work for this SOW can be broken down into five tasks.

Task 1. Coupon preparation and inoculation

The materials and size of the coupons shall be specified by the WAM based upon the inoculation and analytical procedures to be used, which will be specified in the QAPP for each WA the microbiology lab is supporting. There shall be three classes of coupons for each of the DCMD (define acronym DCMD)projects mentioned above: (1) positive controls, (2) negative controls, and (3) test coupons. The positive controls and test coupons shall be spiked with the appropriate *Bacillus* spores' concentration. The negative controls shall undergo the coupon preparation (e.g., sterilization), but shall not be spiked with any target. The spiking procedure shall be appropriately documented in the QAPP. Method demonstration shall be performed and deemed acceptable to the WAM of this WA in conjunction with the WAM of the project the microbiology lab is supporting, prior to the inoculation of the coupons. The basis for acceptability shall be the acceptance criteria set-forth in the QAPP. All positive control, negative control, and test coupons shall be transferred from and to the Biocontaminant lab according to the delivery schedule to be discussed for each project. All transfers shall be accompanied by chain-of-custody (COC) form.

The described procedures are for planning purposes only and may be changed by the WAM, in consultation with the contractor, within the level of effort anticipated for the SOW as currently written.

Task 2. Spore Survivability analyses.

Microbial growth on coupons will be evaluated qualitatively and quantitatively as specified in the standard operating procedures (MOPs 6516, 6526, 6527, 6528, 6529, 6535a, and MOP 6555 -6566) of the Biocontaminant Laboratory Facility manual, or as specified in a QAPP. Under the guidance of the WAM, the contractor shall develop standard diagnostic protocols if necessary to assess microbial survivability.

Task 3. Ancillary Research Projects

Additional projects may be designed and requested by the WAM to fully utilize the contractor personnel during periods of reduced workload. Such projects may include, but are not limited to: laboratory organization and cleaning, limit of detection studies,

sampling efficiency studies, decontaminant technology application and efficacy studies, microbial characterization studies, bacterial spore purification studies, sampling and analysis methods development studies, and studies involving aerosol deposition of spores onto material surfaces. This task may require the contractor to briefly work in Highbay labs or other labs within the EPA-RTP facility.

Task 4. Laboratory Management
The efficiency of the Biocontaminant Laboratory workflow requires effective laboratory management. Therefore, the contractor shall maintain laboratory notebooks of all activities; keep all utilized equipment up-to-date with regards to certification and routine maintenance; maintain inventories of frequently utilized chemicals, reagents, and media as to prevent delays in experimentation due to insufficient supplies; carefully plan all work as to maximize the use of staff; maintain and update MOPs and MSDS repository; perform periodic disinfection of laboratory surfaces and biological safety cabinets; maintain temperature records for laboratory incubators, refrigerators, and freezers; and promptly inform the WAM of any issues associated with laboratory work, workload, equipment failures, or supply needs.

Task 5. Spore Recovery and Inoculum Preparations for Aerosol Testing Research
This task will involve providing microbiological support to on-going and new research initiatives involving aerosol testing. The Aerosol Test Facility (ATF) group will be utilizing spore preps, inoculated coupons, etc. prepared under this task. Also under this task, samples collected during bioaerosol testing within the ATF shall be analyzed for viable microorganisms. Approximately 2000 samples shall be analyzed by culture-based methods, and approximately 200 sample inocula shall be prepared over the course of this Task. The WAM will coordinate with those in the ATF group to ensure efficient transfer of samples between the laboratories. Data shall be reported to the WAM, and PI (indicated by the WAM), as data are available.

X. MILESTONES, DELIVERABLES, AND COMPLETION DATES

Data Delivery
Raw data (e.g., plate counts, qualitative growth results, etc.) shall be emailed to the WAM, and by carbon copy (cc) to the WAM of the project the microbiology lab is supporting, as soon as the data become available (not greater than 2 working days after completion of the analysis generating the data).

Reporting
The Contractor shall provide written quarterly status reports using an MS WORD format to the EPA Biocontaminant lab WAM. The reports shall be prepared specifying the following: (1) summary of work conducted during the preceding months, including tables and/or charts using MS EXCEL format, as appropriate, with sufficient annotation as deemed adequate by the EPA WAMs, (2) analyses of the work in accordance to the expectations specified by the QAPP of each project, (3) progress on each task and the reason for any deviations from the project schedule, (4) work anticipated during the coming quarter. These reports shall be submitted electronically within 5 working days at

the beginning of each quarter (July 1, October 1, January 1). Additionally, pdf copies of the laboratory notebook, including the pages documenting activities performed during the period, shall be created and delivered electronically to the WAM the same day the quarterly report is delivered.

XI. RESPONSIBILITIES

This WA will be managed by the USEPA Office of Research and Development, National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) in Research Triangle Park, NC. The Work Assignment Contractor Officer Representative will be M. Worth Calfee (phone 919-541-7600, email Calfee.Worth@epa.gov).

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-14

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014	
	Base X Option Period Number	

Contractor	Specify Section and paragraph of Contract SOW
ARCADIS U.S., INC.	

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Paul Lemieux (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-0962 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature)	3-27-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

PERFORMANCE WORK STATEMENT
for
Thermal Destruction of CBR Contaminants

PURPOSE OF WORK ASSIGNMENT

The contractor shall provide support for operation, maintenance, sampling/analysis, and modification to the bench-scale thermal destruction reactor and rainbow furnace. *This work assignment is applicable to Contract Sections 1.2, 2.0, 3.0, 4.0, 5.0, and 6.0.*

BACKGROUND

This project supports the Decontamination and Consequence Management Division within EPA's National Homeland Security Research Center. In the event of a terrorist attack on a building our outdoor area using chemical/biological/radiological (CBR) contaminants, a significant amount of the material in the building may be disposed of through thermal incineration. Similarly, disposal of waste resulting from an agro-terrorist event may also be disposed of through thermal treatment techniques.

The primary goal of this project is to examine phenomena associated with thermal destruction of decontamination waste.

This project has initially used simulants for BW and CW agents, and now that the experimental methodologies have been worked out, will be performed using ultra-dilute CW agents (GB, HD, and VX), available from the Environmental Response Laboratory Network (ERLN) as 10 ppm GC/MS standards. The combustor behavior of BW agents can be simulated using harmless bacteria such as *Geobacillus stearothermophilus* and CW agents can be simulated using chemicals of similar volatility or chemical makeup such as Malathion, dimethyl methylphosphonate (DMMP), diisopropyl methylphosphonate (DIMP), or ethylene glycol. Some experiments will be performed using TETS, a rodenticide of concern as a TIC. Radiological agents can be simulated using non-radioactive isotopes (e.g., ^{133}Cs to simulate ^{137}Cs)

The majority of CW experiments will be performed inside a laboratory fume hood using small pipe enclosures (previously developed in this project) and a GC oven, to simulate heating behavior from a real incinerator.

The materials to be used and simulated will include, but not be limited to the following: concrete, asphalt, carpet, ceiling tiles, plywood, wallboard, seat cushions, and fabric. Agricultural and biomass materials may include plant matter, animal tissue (hamburger), or meat and bone meal (dry dog food).

Previous testing was performed (started under WA 2-41 and continued under WA 3-14) examining the combustion of cesium-containing biomass in the Rainbow furnace, with the addition of sorbent to evaluate the sorbents' ability to capture cesium from the

furnace flue gases. Based on analysis of the data, it was determined that it is necessary to run the test matrix using a different biomass (Pine Flour).

DETAILED TASK DESCRIPTIONS

Task 1) The contractor shall perform testing in a laboratory oven such as those found in a gas chromatograph, that mimic heating rates previously observed in the rotary kiln incinerator simulator, as per the existing QAPP. These tests will be performed on the ultra-dilute chemical agents GB, HD, and VX. A complete series of experiments (3 temperatures, 3 residence times, 7 replicates) will be performed on each compound.

Task 2) The contractor shall coordinate with the APPCD Organic Analytical Laboratory to receive samples and analyze them. The purchase of laboratory expendables will be required. There may be some method development work to assure reliable sampling and analysis from the pipe enclosures.

Task 3) The contractor shall provide support from a biology, chemistry, and safety standpoint to minimize cross contamination between samples, to assure valid sample collection, and to provide personnel protection.

Task 4) The contractor shall purchase any expendable materials for use in this project, including the feed materials (building materials), chemical simulants, and instrument calibration gases. Ultra-dilute CWAs will be supplied by EPA.

Task 5) The contractor shall provide fabrication support for the development of the in-situ electronic BI device that is under development.

Task 6) The contractor shall run additional cesium contaminated biomass combustion experiments performed on the Rainbow furnace in the same manner as performed under previous WA, using the existing QAPP developed under WA 2-41. The following run conditions, along with associated sampling and analytical activities as per WA 2-41 and its QAPP, shall be performed in triplicate, for a total of approximately 10 days of testing:

- Corn Flour/Cesium/Sorbent
- Pine Flour Alone
- Pine Flour/Cesium
- Pine Flour/Cesium/Sorbent

Additional elemental analysis of the sorbent material shall be performed using X-Ray Fluorescence (XRF).

Expected numbers of experimental runs are as follows, with minor adjustments in the experimental program to be submitted as technical direction from the WAM, as long as the overall WA value does not increase:

- Bench-scale experiments with GB: 3 temperatures x 7 replicates x 3 residence times + associated blanks and controls
- Bench-scale experiments with HD: 3 temperatures x 7 replicates x 3 residence times + associated blanks and controls
- Bench-scale experiments with VX: 3 temperatures x 7 replicates x 3 residence times + associated blanks and controls

Task 7) The contractor shall complete the data report writing for the cesium contaminated biomass combustion experiments performed on the Rainbow furnace.

DELIVERABLES

1. Planning Meetings: The WAM and contractor's project manager shall arrange project meetings to discuss Task-specific progress, issues, and action items.

2. Monthly Task Progress and Cost Reports: The Contractor's monthly report to EPA shall summarize work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges.

3. Health and Safety Research Protocols: Health and safety research protocols shall be prepared or updated as required by the EPA Facility and APPCD safety personnel. These protocols shall be approved by the WAM and safety personnel prior to the conduct of any testing.

4. Documentation for any Fabricated Devices: As the temperature measurement device and grab sample device are developed, the contractor shall supply documentation for construction and operation of the devices suitable for inclusion in the RKIS facility manual.

5. Quality Assurance Project Plans (QAPPs) and Test Plans (QATPs): The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The contractor shall prepare a QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality

6. Data Reports: The Contractor shall prepare data summaries and Quality Control data reports of all facility-specific data in lieu of an overall final report. Each Quality Control report shall be in a format suitable for EPA/NHSRC publication and shall discuss how well various measurements described in the QA plan were met.

NHSRC QUALITY ASSURANCE REQUIREMENTS FORM
Attachment 1 to the Statement of Work

I GENERAL INFORMATION

Title:	Thermal Destruction of CB Contaminants
Description:	Examine phenomena associated with thermal destruction
Project ID:	DCMD C.4.1.1.1
Status:	Original
Number Ammended:	
QA Category:	III
Action Type:	Extramural
Peer Review Category:	
Security Classification:	Unclassified
Project Type:	Applied Research
QAPP Status 1:	Existing QAPP
Vehicle Status:	Existing Vehicle
Vehicle Type:	Vehicle Number: EP-C-09-027 Work Assignment Number: 3-14 Delivery/Task Order Number: n/a Modification Number: n/a Other:

*If you are processing an **IAG** or **CRADA**, the responsibility for QA must be negotiated within the agreement. The TLPs in consultation with the QAMs in the various organizations must agree on, and document, which organization will take the lead for QA, the names of the QAM and TLP from each organization, and the QA requirements that will be adhered to during the agreement. Include this info in the IAG/CRADA package.*

II SCOPE OF WORK

Yes — Does the Statement of Work contain the appropriate QA language?

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with the R-2 and R-5 and/or the attachments provided with the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf

Yes — Does this extramural action involve the collection, generation, use, and/or reporting of environmental data; the design, construction, and operation of environmental technologies; or development of software, models, or methods?
(If "No" then skip to Section IV, and sign the form.)

No — Will the SOW or any subsequent work assignments or task orders involve any cross-organizational efforts within EPA?

Yes — Has a QAPP already been approved for the activities specified in the SOW?

Provide the title, date or revision number, and date of QA approval:

Destuction of CB Contaminats August 2010

Does the QAPP require *any* revision by the contractor**

no

Yes — Is an applicable QAPP in the process of being prepared, revised, or approved by EPA personnel for future use by the contractor? (QA approval must be obtained before the contractor can start work.)

Provide the expected title for submission to QA staff for approval:

Destruction of CB Contaminants

Provide the approximate date for submission to QA staff for approval:

03/12/2012

*** The term "contractor" applies loosely here, such that as applicable, this term can also mean "awardee", "cooperator" and/or "grantee". Likewise, the term "contract" includes "agreements" and other vehicles.* ?

III QA DOCUMENTATION OPTIONS

All documentation specified under "Other" must be defined in the NHSRC Quality Management Plan and be consistent with requirements defined in EPA Manual 5360 A1. For all items checked below, there must be adequate information in the SOW (or its appendices) for the offeror to develop this documentation. Where applicable, reference a specific section of the SOW. *(R-2 refers to EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, 03/20/01) and R-5 refers to EPA Requirements for Quality Assurance Project Plans (QA/R-5) (EPA/240/B-01/003, 03/20/01). Copies of these documents are available at http://www.epa.gov/quality/qa_docs.html.)*

After Award Documentation

	Documentation of an organization's Quality System. QMP developed in accordance with:
Not Applicable	Combined documentation of an organization's Quality System and application of QA and QC to the single project covered by the contract: Developed in accordance with:
Other	Documentation of the application of QA and QC activities to applicable project(s). Developed in accordance with:
	Explain: The QAPP developed August 2010 will be reviewed by EPA QA Manager.
n/a	Programmatic QA Project Plan with supplements for each specific project, developed in accordance with:
Not Applicable	Existing documentation of the application of QA and QC activities will be used:

IV SIGNATURE BLOCK

The signatures below verify that the Statement of Work (SOW) has been reviewed to ascertain the necessary QA and QC activities required to comply with EPA Order 5360.1 A2, that the COR understands these requirements, and that the COR will ensure that the quality requirements indicated on the previous pages of this form are incorporated into all associated SOWs. *(Sign/date below, obtain a concurrence signature from the QA Staff, and submit the form along with the other extramural action documentation.)*

Paul Lemieux NHSRC-DCMD Technical Lead Person	03/12/2012 Date	Ramona Sherman NHSRC-IO QA Staff Member	03/12/2012 Date

QAPP REQUIREMENTS FOR APPLIED RESEARCH PROJECTS
(from Appendix B of the NHSRC QMP)

An applied research project is a study to demonstrate the performance of technologies under defined conditions. These studies are often pilot- or field-scale. The following requirements should be addressed as applicable

SECTION 0.0, APPROVAL BY PROJECT PARTICIPANTS

The EPA Technical Lead Person (TLP) shall be responsible for obtaining signatures of appropriate project participants on the signature page of the QA plan, documenting agreement to project objectives and the approach for evaluating these objectives

A distribution list shall be provided to facilitate the distribution of the most recent current version of the QAPP to all the principal project participants.

SECTION 1.0, PROJECT DESCRIPTION AND OBJECTIVES

1.1 The purpose of study shall be clearly stated.

1.2 The process, site, facility, and/or environmental system to be tested shall be described.

1.3 Project objectives shall be clearly stated and identified as primary or non-primary.

SECTION 2.0, PROJECT ORGANIZATION

2.1 Key points of contact for each organization involved in the project shall be identified

2.2 All QA Managers and their relationship in the organizations (*i.e.*, location within each organization) shall be identified with evidence that the QA Manager is independent of project management

2.3 Responsibilities of all other project participants and their relationship to other project participants shall be identified meaning that organizations responsible for planning, coordination, sample collection, sample custody, measurements (*i.e.*, analytical, physical, and process), data reduction, data validation, and report preparation shall be clearly identified

SECTION 3.0, EXPERIMENTAL APPROACH

3.1 The general approach and the test conditions for each experimental phase shall be provided. The statistical methods that will be used to evaluate the data (*i.e.*, ANOVA, or summary statistics) should be identified.

(NOTE: As deemed appropriate to the project by the TLP, the information requested in Sections 3.2, 3.3, and 3.4 may be presented here or in Section 4; the information requested in Sections 3.5 may be presented here or in Section 5; and the information requested in Sections 3.6 may be presented here or in Section 7.)

3.2 The sampling strategy shall be included and evidence must be presented to demonstrate that the strategy is appropriate for meeting primary project objectives, *i.e.*, a description of the statistical method or scientific rationale used to select sample sites and number of samples shall be provided.

3.3 Sampling/monitoring points for all measurements (*i.e.*, including locations and access points) shall be identified.

3.4 The frequency of sampling/monitoring events, as well as the numbers for each sample type and/or location shall be provided, including QC and reserve samples.

3.5 All measurements (*i.e.*, analytical [chemical, microbiological, assays], physical, and process) shall be identified for each sample type or process, and project-specific target analytes shall be listed and classified as critical or noncritical in the QAPP.

3.6 The planned approach (statistical and/or non-statistical) for evaluating project objectives shall be included

SECTION 4.0, SAMPLING PROCEDURES

4.1 Whenever applicable, the method used to establish steady-state conditions shall be described.

4.2 Known site-specific factors that may affect sampling/monitoring procedures shall be described.

4.3 Any site preparation needed prior to sampling/monitoring shall be described.

4.4 Each sampling/monitoring procedure to be used shall be discussed or referenced. If compositing or splitting samples, those procedures shall be described.

4.5 For samples requiring a split sample for either QA/QC purposes or for shipment to a different laboratory, the QAPP shall identify who is responsible for splitting samples, and where the splitting is performed (*e.g.*, field versus lab).

4.6 If sampling/monitoring equipment is used to collect critical measurement data (*i.e.*, used to calculate the final concentration of a

critical parameter), the QAPP shall describe how the sampling equipment is calibratec, the frequency at which it is calibrated, and the acceptance criteria for calibration or calibration verification as appropriate.

4.7 If sampling/monitoring equipment is used to collect critical measurement data, the QAPP shall describe how cross-contamination between samples is avoided.

4.8 The QAPP shall include a discussion of the procedures to be used to assure that representative samples are collected

4.9 A list of sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis, shall be specified.

4.10 Containers used for sample collection, transport, and storage for each sample type shall be described.

4.11 Describe how samples are uniquely identified

4.12 Sample preservation methods (*e.g.*, refrigeration, acidification, *etc.*), including specific reagents, equipment, and supplies required for sample preservation shall be described

4.13 Holding time requirements shall be noted

4.14 Procedures for packing and shipping samples shall be described

4.15 Procedures to maintain chain of custody (*e.g.*, custody seals, records) during transfer from the field to the laboratory, in the laboratory, and among contractors and subcontractors shall be described to ensure that sample integrity is maintained

4.16 Sample archival requirements for each relevant organization shall be provided

SECTION 5.0, TESTING AND MEASUREMENT PROTOCOLS

5.1 Each measurement method to be used shall be described in detail or referenced Modifications to EPA_approved or similarly validated methods shall be specified.

5.2 For unproven methods, verification data applicable to expected matrices shall be included in the QAPP meaning the QAPP shall provide evidence that the proposed method is capable of achieving the desired performance

5.3 For measurements which require a calibrated system, the QAPP shall include specific calibration procedures applicable to each project target analyte, and the procedures for verifying both initial and continuing calibrations(including frequency and acceptance criteria, and corrective actions to be performed if acceptance criteria are not met).

SECTION 6.0, QA/QC CHECKS

6.1 At a minimum, the QAPP shall include quantitative acceptance criteria for QA objectives associated with accuracy, precision, detection limits, and completeness for critical measurements (process, physical, and analytical, as applicable) for each matrix.

6.2 Any additional project-specific QA objectives shall be presented, including acceptance criteria. This includes items such as mass balance requirements.

6.3 The specific procedures used to assess all identified QA objectives shall be fully described

6.4 The QAPP shall list and define all other QC checks and/or procedures (*e.g.*, blanks, surrogates, controls, *etc.*) used for the project, both field and laboratory.

6.5 For each specified QC check or procedure, required frequencies, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met shall be included

SECTION 7.0, DATA REPORTING , DATA REDUCTION , AND DATA VALIDATION

7.1 The reporting requirements (*e.g.*, units, reporting method [wet or dry]) for each measurement and matrix shall be identified.

7.2 The deliverables expected from each organization responsible for field and laboratory activities shall be listed

7.3 Data reduction procedures specific to the project, and also specific to each organization, shall be summarized.

7.4 Data validation procedures specific to each organization used to ensure the reporting of accurate project data to internal and external clients shall be summarized.

7.5 Data storage requirements for each organization shall be provided

7.6 The product document that will be prepared for the project shall be specified(*e.g.*, journal article, final report, *etc.*). The contents of this document can be referenced to a NHSRC or program-specific QMP, if appropriate.

SECTION 8.0, ASSESSMENTS

8.1 The QAPP shall identify all scheduled audits (*i.e.*, both technical system audits [TSAs] and performance evaluations [PEs]) to be performed, who will perform these audits, and who will receive the audit reports.

8.2 The QAPP shall provide procedures that are to be followed that will ensure that necessary corrective actions will be performed.

8.3 The responsible party(-ies) for implementing corrective actions shall be identified.

SECTION 9.0, REFERENCES

References shall be provided either in the body of the text as footnotes or in a separate section.

Attachment # 2

NHSRC QA
To the Statement of Work
Requirements/Definitions List

EPAs Quality System Website: http://www.epa.gov/quality
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html
EPA's Quality System Website: http://www.epa.gov/quality/qs-docs/r5-final.pdf

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

NHSRC QA Requirements/Definitions List
Category Level Designations (determines the level of QA required):

☐ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP: QAPP** requirements for the specific project type (see below).

☐ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP QAPP** requirements for the specific project type (see below).

Project Types:

These outlines of NHSRC's QAPP Requirements for various project types, from Appendix B of the NHSRC QMP (except where otherwise noted), are condensed from typically applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These lists and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

☐ **Applied Research Project** - pertains to a study performed to generate data to demonstrate the performance of accepted processes or technologies under defined conditions. These studies are often pilot- or field-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Applied Research Projects" from Appendix B of the NHSRC QMP.

☐ **Basic Research Project** - pertains to a study performed to generate data used to evaluate unproven theories, processes, or technologies. These studies are often bench-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Basic Research Projects" from Appendix B of the NHSRC QMP.

☐ **Design, Construction, and/or Operation of Environmental Technology Project** - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" G-11, at http://www.epa.gov/quality/QS-docs/g11-final-05.pdf. For additional information, you may refer to Part C of "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology," ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995.

☐ **Geospatial Data Quality Assurance Project** - pertains to data collection; data processing and analysis; and data validation of geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" G-5S at http://www.epa.gov/quality/QS-docs/g5g-final-05.pdf.

☐ **Method Development Project** - pertains to situations where there is no existing standard method, or a standard method needs to be significantly modified for a specific application. The QAPP shall address all requirements listed in "QAPP Requirements for Method Development Projects" from Appendix B of the NHSRC QMP.

☐ **Model Development Project** - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" G-5M at http://www.epa.gov/quality/QS-docs/g5m-final.pdf.

☐ **Sampling and Analysis Project** - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information. The QAPP shall address all requirements listed in "QAPP Requirements for Sampling and Analysis Projects" from Appendix B of the NHSRC QMP.

☐ **Secondary Data Project** - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. The QAPP shall address all requirements listed in "QAPP Requirements for Secondary Data Projects" from Appendix B of the NHSRC QMP.

☐ **Software Development and Data Management Project** - pertains to software development, software/hardware systems development, database design and maintenance, data validation and verification systems. The QAPP shall address all requirements listed in "QAPP Requirements for Software Development Projects" from Appendix B of the NHSRC QMP.

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program,

and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/qs-docs/r2-final.pdf

R-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf.

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Technical Lead Person (TLP) - This person is technically responsible for the project. For extramural contract work, the TLP is typically the contracting officer's representative (COR). For intramural work, the TLP is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
NRMRL	National Risk Management Research Laboratory	QAM	Quality Assurance Manager
QA ID	Quality Assurance Identification	QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan	SOW	Statement of Work
QS	Quality System	CRADA	Cooperative Research & Development Agreement
TLP	Technical Lead Person		

Attachment #2 to the Statement of Work
Revision 1. March 2006
NHSRC 06/02

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-15

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Identification and Development

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Xiaoyu Liu (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-2459 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 3/21/13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

FY13 Statement of Work WA 4-15

WA Title: Indoor Source Emissions and Sink Effect Study of Formaldehyde

1. Purpose

The overall objective of this project is to improve indoor air quality and public health and impact the green chemistry movement. This project is to investigate the formaldehyde source emissions and sink effect characteristics of consumer products on indoor air quality for supporting EPA's formaldehyde regulations and formaldehyde risk assessments.

This WA is a continuation of WA 3-15.

2. Background

Improving air quality and assuring the safety of chemicals are two of the seven priorities for USEPA announced by the administrator in January 2010. Formaldehyde is listed as a probable carcinogen by EPA. The US National Academy of Sciences (NAS) is conducting an expedited peer review of EPA's formaldehyde risk assessment. Formaldehyde research fits these priorities and EPA's Chemical Safety for Sustainability (CSS) program.

On July 7, 2010, Present Obama signed the Formaldehyde Standards for Composite Wood Products Act (S.1660). This legislation pre-empts a TSCA Section 21 Petition and requires EPA to implement on a national basis the California regulation of formaldehyde emissions from three types of pressed-wood products and finished goods containing these materials, produced or imported into the US, as determined by ASTM E-1333 or an "equivalent" test method. This far-reaching legislation requires that EPA establish processes for testing, certification, and labeling of pressed-wood materials and finished goods by January 31, 2013. Thus, there is an immediate and critical need to develop and demonstrate emissions test methodologies for finished goods and establish equivalency to formaldehyde emissions limits specified in the legislation. The creation of well-characterized reference materials for formaldehyde emissions testing is very important to improve emissions measurement methods. A widely accepted formaldehyde standard source

could be used by laboratories to calibrate an apparatus, assess a measurement method, identify and eliminate the uncertainties involved in these measurements. It could also enable international harmonization of formaldehyde chamber test methods. EPA is in collaboration with National Institute for Standards and Technology (NIST) to conduct research on development and demonstration of a standard HCHO emissions source for evaluating emissions test chamber performance.

Additionally, EPA is conducting registration review for antimicrobial biocides that release formaldehyde. To help EPA address the potential risks to humans resulted from the use of biocides in occupational and residential settings, chamber studies and air monitoring data and model are needed to determine the amount of HCHO off-gassing from biocide-treated paint and detergents.

In 2012, the ARCADIS Contractor under Contract EP-C-09-027 WA 3-15 had: (1) conducted 11 small chamber tests to evaluate the formaldehyde reference material produced by EPA's contractor –Virginia Tech; (2) measured formaldehyde Henry's law constants in aqueous with and without surfactants under different concentrations and temperatures using developed analytical method. Under this WA, the Contractor shall provide technical support to EPA by conducting source emission tests in environmental chambers and providing data for formaldehyde source emission model evaluation.

3. Task Descriptions

The Contractor shall conduct the following tasks:

Task 1. Formaldehyde Reference Material Study

EPA's contractor, Virginia Tech, has developed the formaldehyde reference material for formaldehyde emissions testing to demonstrate the feasibility of using this source to evaluate emissions test chamber performance. After the first round of small chamber emission tests by ARCADIS, Virginia Tech will provide more materials for further investigation and improvement. Upon receiving the developed formaldehyde standard source, the Contractor shall measure the emission rate and profile of the formaldehyde standard source in small chambers and report the results. The test procedures will follow the developed QAPP that used for the tests in FY2012.

Task 2. Henry's Law Constants Study

The Contractor shall conduct small chamber and bottle tests to measure formaldehyde emissions and Henry's law constants. The EPA Work Assignment Manager (WAM) will provide further technical details for the tests to the Contractor. The data will be used to develop/evaluate IAQX models.

Task 3. Formaldehyde Biocide Study

The contractor had conducted small chamber source emission tests of one biocide, Grotan, in paint. EPA will identify another biocide that will be a formaldehyde releaser. The Contractor shall conduct small chamber and large chamber tests with new biocides. The test protocol for small chamber tests should follow the QAPP that was prepared for Grotan/paint tests. The EPA WAM will provide details for the large chamber tests. The data will be used to develop/evaluate IAQX models.

Task 4. QAPP Update

The quality assurance plan prepared by the Contractor was approved in 2011. With the change of scope of work, the Contractor shall write a QAPP amendment to include all tests/tasks changes for this work assignment as needed.

4. Schedule of Tasks, Reports, and Deliverables

The Contractor shall submit the updated QAPP within 30 days of receiving the directions from the WAM. The contractor shall also provide (1) test material information; (2) environmental data for each test; (3) sampling information; (4) analytical data in excel files. These shall be submitted to WAM within 10 business days after each test.

The Contractor shall provide the EPA WAM monthly progress reports as specified in the contract. The Contractor shall alert the WAM in advance if they expect a substantial delay in completing the task or submitting the deliverable.

5. Suggested Skills

This project will require Contractor staff with the skill of modification and adaptation of scientific apparatus to meet project objectives. It is recommended that this Work Assignment be lead by a scientist or engineer with experience in testing product emissions and operating small environmental chambers.

6. Special Requirements

The Contractor shall provide necessary health and safety procedures, documentation, and training to Contractor staff to ensure safe conduct of the experiments at Contractor controlled facilities.

The contractor shall adhere to the QA requirements as delineated in Attachment #1 to the Statement of Work. Work shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

7. Work Assignment Manager Designation

The Work Assignment Manager (WAM) is:

Dr. Xiaoyu Liu
U.S. Environmental Protection Agency
National Risk Management Research Laboratory
Air Pollution Prevention and Control Division
Indoor Environment Management Branch
Mail Code E305-03
Research Triangle Park, NC 27711
Telephone:. 919-541-2459
Fax: 919-541-2157
E-mail: liu.xiaoyu@epa.gov

8. Work Assignment Duration and Level of Effort

The period of performance for this work assignment is from the date this work assignment is issued through March 31, 2014.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-16

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Ozone Standard Reference Photo

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Bobby Gore (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-4499 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 3-27-13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Period of Performance: 04/01/2013 – 03/31/2014
Work Assignment Manager (WAM): Scott A. Moore
Work Assignment Title: Ozone Standard Reference Photometer (SRP) Metrology Laboratory Support
Contract Number: EP-C-09-027
Work Assignment Number: 4-16

Introduction

The Office of Air and Radiation (OAR) develops national programs, policies, and regulations for controlling air pollution and radiation exposure. OAR is concerned with pollution prevention and energy efficiency, indoor and outdoor air quality, industrial air pollution, pollution from vehicles and engines, radon, acid rain, stratospheric ozone depletion, climate change, and radiation protection. OAR is responsible for administering the Clean Air Act, the Atomic Energy Act, the Waste Isolation Pilot Plant Land Withdrawal Act, and other applicable environmental laws. The Office of Air Quality Planning and Standards (OAQPS) has the primary mission of preserving and improving air quality in the United States. To accomplish this, OAQPS:

- compiles and reviews air pollution data,
- develops regulations to limit and reduce air pollution,
- assists states and local agencies with monitoring and controlling air pollution,
- makes information about air pollution available to the public, and
- reports to Congress the status of air pollution and the progress made in reducing it.
- Additional information on OAQPS can be found in the following websites.

http://www.epa.gov/ttn/amtic/

http://www.epa.gov/ttn/amtic/npepqa.html

http://www.epa.gov/ttn/amtic/srpqa.html

In ambient air monitoring applications, gas concentration standards are required for the calibration and auditing of various ambient gas monitors. Because of the instability of ozone (O_3), the certification of O_3 concentrations as Standard Reference Materials (SRMs) is impossible. Therefore a Standard Reference Photometer (SRP) was developed as a primary standard to validate the linearity of other photometers when challenged with various concentrations of locally generated O_3 gas. An SOP (Standard Operating Procedure) is being prepared to assist the EPA (Environmental Protection Agency) operators of the NIST (National Institute of Standards and Technology) Standard Reference Photometer (SRP) in terms of operation, repairs, and verification.

A collaborative effort between NIST and EPA in the development of the original SRPs has become the basis for O_3 measurements globally. The SRP Program began in the early 1980's as collaborative effort between NIST and the EPA to design, construct, certify and deploy a network of identical O3 reference instruments. The design specifications called for an instrument with a standard uncertainty of ±2 nmol/mol (ppb_v) in the range of 0 nmol/mol to 1000 nmol/mol. Since the SRPs have been deployed, beginning in 1983; the performance of all SRP's has exceeded the design specifications. In the US, two (2) SRPs are maintained by NIST, one serving as the NIST standard and the other as a backup/travelling instrument. Eleven (11) additional SRPs are maintained by the EPA at various EPA Regional laboratories across the United States to facilitate requests for local access to authoritative (ie, NIST) reference standards. With current international network of SRPs total nearly fifty (50) SRPs worldwide that now includes instruments maintained in at least fifteen (15) countries. The international network is coordinated by the Bureau International des Poids et Mesures (BIPM) in France, which maintains the international responsibility for the comparison of national O_3 standards as the NIST does here in the United States.

Over the past several years, the network of NIST SRPs has undergone significant upgrades in its electronic systems, sampling configuration, and control software. Each SRP consists of a separate optical bench and two instrumentation modules (electronics and pneumatics). The (Ultra Violate) UV photometer consists of a low-pressure mercury discharge lamp, UV filter, UV beam splitter, two absorption cells, and signal-processing electronics.
A new electronics module was designed as a plug-compatible replacement for the original unit to simplify upgrading of existing systems in May 2003. Several improvements were made in the overall electronics module design to provide enhanced stability and to simplify operation.

I. Goal/Purpose

Field Code Changed

The objective of this Work Assignment (WA) is to provide Metrology Laboratory (MetLab) support to the SRP Program via the Office of Air Quality Planning and Standards (OAQPS). This is a facility with the capabilities to validate and repair other SRPs in various regions in order to maintain NIST tractability. The following table has the Region Number, the location, the SRP Serial Number for that region and a contact name:

SRP	Region	Location	Name
8	8	Golden, CO	Joshua Rickard
36	9	Richmond, CA	Barbara Bates
4	10	Sacromento, CA	Jerry Freeman
10	4	Athens, GA	Mike Crowe
1	RTP	RTP, NC	Scott Moore
7	RTP	SRP7 to NIST	Scott Moore
13	7	Kansas City, KS	James Regehr

9	1	N. Chelmsfield, MA	Chris St. Germain
6	5	Chicago, IL	Scott Hamilton
3	2	Edison, NJ	Avraham Teitz
5	6	Houston, TX	John Lay

Each year SRP-01 is taken to NIST for re-validation. SRP-07 is then re-validated against SRP-01 back at the RTP Laboratory. In turn, SRP-07 is then shipped around the country to be compared to each of the other 9 regional SRPs in order to maintain NIST traceability. SRP-07 is shipped back to RTP in-between each regional comparison (or as often as possible) to check the status of the instrument. In turn various state and local authorities are able to go to a regional office to compare their lab standard or transfer standard and be able to maintain NIST tractability throughout the Ozone monitoring program.

II. Background Information

Field Code Changed

Data Uses — Primary users of the products of this WA will be researchers and operators of Ozone monitoring equipment in EPA facilities. There are various groups that have Ozone monitoring equipment that may call on EPA for validation, such as Alion, Arcadis, the State of NC and the State of Florida, the State of Virginia and other local researchers.

Lab Site — Work area is D360-A in EPA's Research Center in Research Triangle Park, NC.

Experience — Personnel assigned to this WA must be familiar with performing calibrations that the Metrology Laboratory can provide, which include electrical work, plumbing, general experience with laboratory equipment and materials, a familiarity with the calibration of measurement devices, and a fundamental understanding of the principals behind the measurements.

III. Tasks: OZONE SRP Laboratory Support

Field Code Changed

Task I. Shipping and Receiving of SRPs or other Ozone monitors

Field Code Changed

(1) The Contractor shall receive a SRP from one of the regions and unpack the equipment and set it up in D-360A in preparation of running a validation.

(2) The Contractor shall break down a SRP or Ozone monitor in preparation to ship the instrument or in preparation for the owner of the equipment to pick it up from D360-A

(3) All shipping is funded by OAQPS, therefore the Contractor shall relay shipping information m (i.e. container size, weight, destination, date and priority) to OAQPS for labels to be printed. The Contractor shall make arrangements to have the equipment picked up or delivered to D360-A.

(4) Some travel may be required to get the SRP from one location to another without using a shipping company, in these rare instances the contractor shall make arrangement to travel to a specified location to pick up or drop off the SRP.

(5) The Contractor shall become familiar with the Draft SOP for the SRP (provided by the WAM) and also the Draft: Transfer Standards for Calibration of Air Monitoring Analyzers for Ozone (PDF) (67pp, 820 KB) - May 31, 2009 as found on the website: http://www.epa.gov/ttn/amtic/srpqa.html

Task II. MetLab Operations

(1) The Contractor shall maintain the Zero Air Supply used for the Ozone Lab. OAQPS purchased a new Zero Air Generator for the Ozone Lab in January of 2012. Now that the Zero Air Generator has been received and installed the contractor shall maintain a monthly and annual routine maintenance schedule and log for it.

(2) The Contractor shall perform minor repairs on the SRPs as per Technical Directives from the WAM

(3) The Contractor shall maintain a calibration schedule for various support instrumentation such as the Barometric Pressure Sensor, the STOLAB Temperature calibrator and the Fluke Digital Volt Meter. OAQPS will be responsible for the costs of calibration of these instruments and the Contractor shall relay these costs to OAQPS

(5) The contractor shall perform QA evaluations using Excel and Word templates provided with the SRP Software.

(6) The Contractor shall provide the WAM with any calibration that is performed for final approval, before it is released to any other entity.

(7) The WAM shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WAM.

(8) Formatting of reports should be comparable to historical reporting (using the same or very similar format used during the previous year) and electronic files should be compatible with Agency Standard Software, such as MS Excel 2007, MS Word 2007 and Adobe Reader 10.0 or current agency standard software. Any data recorded by the Ozone instrument (i.e. ozone, temperature, pressure, UV intensity) are automatically entered into a formatted spreadsheet and it automatically calculates the statistical

variance of each data set. To make changes to this format, without an intimate knowledge of how the NIST SRP Software uses it, would prevent the instrument from working. Therefore, the same format should be used every time a calibration is performed. Hard copies of reports are acceptable; however, electronic copies are encouraged.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-17

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014	Fugitve and Fencline Technique
	Base X Option Period Number	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2009 To 03/31/2010

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Eben Thoma (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7969 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates (Signature) 3-27-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

SOW: Fenceline and Fugitive Emissions Measurement Techniques
EP-C-09-027 WA 4-17

Background:

Reducing fugitive emissions of greenhouse gases (GHGs), hazardous air pollutants (HAPs), other volatile organic compounds (VOCs), and certain inorganic gases from industrial facilities is an ongoing priority for EPA and our state and local co-regulators. Unlike stack emissions, fugitive releases are difficult to detect due to the spatial extent and inherent temporal variability of the potential sources.

Fenceline and process monitoring by optical remote sensing (ORS), infrared cameras, mobile measurement, and emerging sensor techniques can augment manual Leak Detection and Repair LDAR programs (where they exist) by providing near real-time gas emissions data. Time-integrated passive sampling is also important emerging screening approach (reference draft method 325A and B). The detection of fugitive emission by a time-resolved monitors, coupled with wind direction data, can be used to pinpoint and repair fugitive leaks with short response times, greatly decreasing the potential for emissions.

This work Assignment (WA) continues previous efforts in the fenceline and fugitive emission topic area. Please refer to EP-C-09-027 WA: 2-43, 2-59, 3-17, 3-24, 3-37, 3-63, and 3-70 for background information on passive sampling, infrared cameras, deep ultraviolet optical sensor (DUVOS) technology, advanced UV and IR open path and point monitoring systems, low cost sensors, and mobile monitoring with geospatial measurement of air pollution (GMAP) approaches. This goal of this WA is to consolidate and continue development of select aspects of these technologies, demonstrate them in the field where possible, and document them through method development activities. Aspects of this work assignment will work in concert with WA 4-70.

Work involving collection of environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff. The Quality Assurance Project Plans (QAPPs) associated with these tasks shall be a Category III level (unless otherwise specified) and must include all necessary elements as described in the referenced documentation (See Attachment 1).

All QAPPs and QAPP addendums shall be reviewed and approved by the ARCADIS work assignment leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the ARCADIS work assignment leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the ARCADIS work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page.

For the each of the tasks described below, the contractor shall provide itemized hours and cost estimates as part of the workplan.

Tasks and Deliverables:

Task 1: Development of a general test for facility fenceline monitoring

Under the technical direction of the work assignment manager (WAM), the contractor shall utilize information gained from current and previous efforts, from the literature, and from external consultants (if needed) to develop a performance-based test method for facility fenceline monitoring. The contractors shall participate in meetings with the WAM and the EPA OAQPS Measurements Technology Group to ensure that the method meets Category C requirements and formatting. Category C methods are also called other test methods (OTMs) (http://www.epa.gov/ttn/emc/tmethods.html).

The fenceline OTM shall include generalized instrument technology groupings including (ultraviolet (UV) and infrared (IR) open-path, point monitor (time-resolved and time-integrated), mobile inspection (point, tracer, and solar occultation), and low-cost sensor facility fenceline monitoring approaches. The contractor shall include performance based descriptions of inverse source triangulation and emissions estimations approaches. The test method shall be generalized in form (e.g. not linked to a specific instrument manufacturer or proprietary method) and shall include (as appendices) baseline standard operating procedures (SOPs), with emphasis of performance-based data quality parameters, of all major instrument technology groupings and inverse calculation approaches.

Deliverable 1.1: Method outline delivered by May 31, 2013

Deliverable 1.2: Method draft #1 delivered by August 30, 2013

Deliverable 1.3: Method draft #2 delivered by October 31, 2013

Deliverable 1.4: Final draft method delivered by January 31, 2014

Deliverable 1.5: Final method delivered by March 14, 2014

Task 2: Execution of Sensor Field Studies

Under the technical direction of the WAM, the contractor shall complete development of and preliminary testing of time-resolved fenceline sensors systems under WA 2-17 and shall deploy these systems in the field in conjunction with WA 4-70 (phase 1 only) and other studies to be communicated by the WAM. The contractor shall prepare quality assurance project plan (QAPP) addendums to be incorporated with the parent QAPP (to be provided) for each field deployment. The QAPP addendum shall be a Category III level unless otherwise communicated (Reference Attachment 1). The contractor shall be responsible for all aspects of deployments of the sensor systems in coordination with other groups.

For planning purposes, the contractor shall assume three (3) potential deployments of sensor systems in Regions 3, 6, and 8 each of six (6) month duration.

Deliverable 2.1: Proposed fenceline time-resolved fenceline sensors candidates ready for EPA Review by June 27, 2013.

Deliverable 2.2: QAPP Addendum to a proposed filed study due 30 calendar days from EPA WAM communication of field study incorporation.

Deliverable 2.3: Short-form data analysis report for sensor deployments including QA summaries in Microsoft Word™ and Excel™ formats including all raw and processed files to be delivered on monthly basis beginning 30 days after deployment.

Task 3: General support of emissions, fenceline, and fugitive monitoring projects

Under the technical direction of the WAM, the contractor shall provide support to EPA's fugitive and area source group in the general development, preparation, maintenance, upgrade, and testing of infrared camera, passive and active fenceline, and mobile measurement equipment, methods, reports, and databases. This task shall include machine shop time to procure and construct support materials for passive samplers, sensor systems, mobile systems etc., as per EPA design, for projects pursued by the EPA fugitive and area source group and its collaborators.

The contractor shall revise and update fenceline and mobile measurement SOPs as needed. The contractor shall revise, expand, and document the draft infrared camera database delivered in March, 2013 based on comments to be provided. The contractor shall support potential revisions to previous report products that are currently under additional EPA and external review (as required).

The contractor shall support the development of data analysis procedures for source emissions, fenceline, and mobile measurements and in the processing of said data on an as required basis. For any data analysis activity, the contractor shall provide a short-form data analysis report, including QA summaries in Microsoft Word™ and Excel™ formats along with all raw and processed files and spectral fits for the provided data.

For planning purposes, the contractor shall assume approximately 1.5 man days per week on average of general support needs under this task with no travel requirements. The contractor shall assume no more than $20,000 of materials, supplies, and software development costs associated with this general support task.

Deliverable 3.1: Project support shop functions, database revisions, and data reports delivered within 30 calendar days of receipt of information from EPA WAM (on and as required basis).

Task 4: Report on CO_2 sequestration field monitoring

Under the technical direction of the WAM, the contractor shall deliver a report summarizing all available techniques and performance metrics (with complete journal, commercial source, and in-progress research references) on detection and measurement of CO_2 emissions from CO_2 sequestration field sources. The report shall focus on air monitoring and remote sensing approaches but shall also include other media monitoring approaches for comparison purposes. The report shall include a breakdown of the techniques and performance and cost for each major source category and use regime associated. The contractor shall assume periodic meetings to review progress.

Deliverable 4.1: Draft Outline July 31, 2013

Deliverable 4.2: Report Draft #1 delivered by September 30, 2013

Deliverable 4.3: Report Draft #2 delivered by December 20, 2013

Deliverable 4.4: Final Draft delivered by March 14, 2014

ATTACHMENT #1
TO THE STATEMENT OF WORK (SOW)

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD:

☐ **NRMRL=s Quality System Specifications:**

(1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

☐ **NRMRL=s Quality System Specifications:**

(1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

X **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and Application Projects**

☐ **QAPP Requirements for Software Development Projects**

X QAPP Requirements for Method Development Projects

☐ **QAPP Requirements for Design, Construction, and Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA=s Quality System Website: http://www.epa.gov/quality/
EPA=s Requirements and Guidance Documents:
http://www.epa.gov/quality/qa_docs.html

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
  7.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
  7.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-18

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	PFOA Aged Article Testing (Pha

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Zhishi Guo (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0185 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates 5-14-13 (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Contract: EP-C-09-27
Option 4
WA number: 4-18

Statement of Work

PFOA Aged Article Testing (Phase II)

I. Background and Objective

This WA is a continuation of WA 3-18.

Perfluorooctanoic acid (PFOA) is a surfactant associated with fluoropolymer and fluorotelomer products, and can cause developmental and other adverse effects in laboratory animals. It has been found at very low levels both in the environment and in the blood of the general U.S. population. Investigators have recently reported that PFOA concentrations in indoor air are much higher than those in ambient air. This finding suggests that some consumer products may be major PFOA sources in the indoor environment, and that indoor exposure (e.g., inhalation of dusts and dermal contact with consumer products) may constitute a significant portion of the total exposure to PFOA among the general population. It is known that a wide range of consumer products, also known as articles of commerce (AOCs) may contain PFOA. For instance, according to a recent study, one square meter of carpet treated with fluorotelomer-based stain repellent solutions may contain several hundred micrograms of PFOA. However, the role of these common consumer products on human exposure remains unclear, and there is no information on the release of PFOA during the life cycle of AOCs. EPA's Office of Pollution Prevention and Toxics (OPPT) is currently evaluating the potential health risks associated with PFOA and its analogues, collectively known as perfluorocarboxylic acids (PFCAs). This project – PFOA aged article testing – supports OPPT's data needs by: (1) characterizing the source, transport, and fate of PFOA in the indoor environment, (2) characterizing the factors that may affect PFOA release from consumer products, and (3) examining risk management options for reducing human exposure to PFOA. In the past three years, EPA has completed three reports on PFCAs in consumer articles. To further understand the role of consumer articles in human exposure, EPA is interested in the presence of PFCA precursors in consumer articles. Under the previous WA, the Contractor have developed methods for determination of fluorotelomer alchol (telomer alcohol for short) content in solid and liquid AOCs and analyzed over 30 samples that were collected two years ago. Under this WA, the Contractor shall provide technical support to the Government by (1) collecting additional AOC sample from the current US open market; (2) determine the telomer alcohol content in those samples; and (3) conduct additional tests to evaluate the potential loss of telomer alcohols from AOC samples due to off-gassing and machine washing.

II. Scope of Work

Task 1. Purchase additional AOC samples from the current US open market and determine the fluorotelomer alcohol contents in those samples

The Contractor shall purchase a minimum of 30 types of AOC samples in the following categories:

- Commercial carpet-care liquids
- Household carpet/fabric-care liquids and foams
- Treated carpet
- Treated apparel
- Treated home textile and upholstery
- Treated non-woven medical garments
- Treated floor waxes and stone/wood sealants
- Treated food contact paper

The Contractor shall make certain that the AOC samples collected cover both domestic and imported products (roughly 1:1). The WAM will provide further technical details to the Contractor no later than April 15, 2013 about sample categories and number of samples needed.

The Contractor shall enter all related information (i.e., purchase date, product labels, and MSDS) to computer program STARCK that was developed during Phase I of this project.

The Contractor shall determine the concentrations of telomer alcohols in AOC samples by the GC/MS method that was developed in the previous WA.

Task 2. Evaluate the potential off-gassing of fluorotelomer alcohols from selected AOCs at elevated temperatures

The Contractor shall use the μ-CTE Micro-Chamber/Thermal Extractor to determine the potential off-gassing perfluorotelomer alcohols from at least three AOCs that contain high levels of telomer alcohols. At least one AOC sample shall be tested in duplicate. To avoid the need for air sampling, the Contractor shall analyze the telomer alcohol contents before and after each test. The test conditions are as follows: air flow setting: high; Temperature setting: 65˚C; use of spacer: none.

Task 3. Evaluate the potential loss of fluorotelomer alcohols AOC samples due to machine washing

The Contractor shall examine the potential loss of telomer alcohols from AOCs due to machine washing by comparing the telomer alcohol contents in the AOC samples before and after washing. The Contractor shall select a minimum of three AOC samples from treated apparel, treated home textile and upholstery, and treated non-woven medical garments and wash them

separately with the washing machine located in the High Bay area. Warm water shall be used with and without detergent. The Contractor shall extract the samples and determine the telomer alcohol contents by the GC/MS method.

III. QA/QC

The Contractor shall provide technical support for this project by following the following QA documents:

- *QAPP for Evaluation of PFAA Release from Articles of Commerce (AOCs) — Phase II: Market Monitoring of PFAA Content in New AOCs and Evaluation of Carpet-Care Liquids and Cleaning Methods* (Version 6, December 29, 2012)

- *QAPP Amendment 2: Extraction of Fluorotelomer Alcohols from Articles of Commerce* (June 29, 2012)

- Related MOPs (66xx series).

The contractor shall adhere to the QA requirements as delineated in Attachment #1 to the Statement of Work. Work shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

IV. Acceptance Criteria and Management Controls

The Contractor shall either submit to the WAM a project status report every two weeks or, alternatively, report the status orally at the bi-weekly team meeting.

The Contractor shall alert the WAM in advance when it expects a substantial delay in completing the task or submitting the deliverable.

V. Deliverables

1. The Contractor shall complete all laboratory work no later than May 15, 2013 and post all Test Summary Data Sheets (in Microsoft Excel) no later than May 25, 2013. Before submitting the data, the Contractor shall conduct a data quality review. Each data file shall include the signature of the reviewer and review date.

2. The Contractor shall create and maintain all sample records by using computer program STRACK-II located in the scientific data share \NRMRL_Guo2. The complete sample records for this performance period are due by May 25, 2013.

VI. Personnel

It is recommended that this Work Assignment be lead by a Level III scientist or engineer with

experience in product testing. A level II analytical chemist who is familiar with GC/MS is required.

VII. Work Assignment Manager Designation

The Work Assignment Manager is:

Dr. Zhishi Guo
U.S. Environmental Protection Agency
National Risk Management Research Laboratory
Air Pollution Prevention and Control Division
Indoor Environment Management Branch
Mail Code E305-03
Research Triangle Park, NC 27711
Telephone:919-541-0185
Fax: 919-541-2157
E-mail: guo.zhishi@epamail.epa.gov

The Alternate WA COR is:

Dr. Xiaoyu Liu
U.S. Environmental Protection Agency
National Risk Management Research Laboratory
Air Pollution Prevention and Control Division
Indoor Environment Management Branch
Mail Code E305-03
Research Triangle Park, NC 27711
Telephone:919-541-2459
Fax: 919-541-2157
E-mail: liu.xiaoyu@epamail.epa.gov

VIII. Work Assignment Duration

The performance period for this WA starts from April 1. Because this work is associated with a deliverable due September 30, 2013, the Contractor must complete all the work by May 31, 2013.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-19

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	NHEERL Metrology QA Lab Suppor

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

[ ] Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): [ ]

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Scott Moore (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-5104 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 3-27-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Period of Performance: 04/01/2013 – 03/31/2014
Work Assignment Manager (WAM): Scott A. Moore
Work Assignment Title: NHEERL Metrology QA Laboratory Support
Contract Number: EP-C-09-027
Work Assignment Number: 4-19

Introduction

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To insure adequate QA it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to ensure that it produces reliable data. The National Health and Environmental Effects Research Laboratory (NHEERL) require that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (MetLab) provides QA assistance to NHEERL researchers by providing the procedures and the standards to calibrate various scientific devices.

I. Goal/Purpose

The objective of this Work Assignment (WA) is to provide MetLab support to NHEERL. This MetLab is a facility with the capabilities to check (or audit) the calibration of Environmental Protection Agency (EPA) measurement instrumentation. A second objective is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to ensure and document that the operations performed in EPA facilities will produce data of known and adequate quality. This work assignment does not pertain to the calibration of facility devices, such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons

II. Background Information

Data Uses — Primary users of the products of this WA will be researchers and operators of equipment in EPA/NHEERL facilities. Calibration and PEA results can be reported in research reports to support or verify findings.

Lab Site — The MetLab is located in rooms D360-A, D362, and D364-A in EPA's Research Center in Research Triangle Park, NC.

Experience — Personnel assigned to this WA must be capable of performing the tasks listed in Section III (Tasks), which include electrical work, plumbing, general experience with laboratory equipment and materials, a familiarity with the calibration of measurement devices. Personnel should also have an understanding of the principals behind the measurements and the ability to reduce data and report it according to the International Organization for Standardization ISO 17025 "General Requirements for the

Competence of Calibration and Testing Laboratories" (ISO 17025) and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

III. Tasks: Metrology Quality Assurance Laboratory Support for NHEERL

Task 1 Lab Equipment and Supplies

(1) The Contractor shall obtain performance specifications on potential calibration equipment. The Contractor shall maintain and upgrade calibration systems and equipment as needed. Final decisions regarding upgrading and replacing equipment will be relayed to the Contractor in a technical directive through the WAM.

(2) The Contractor shall maintain MetLab equipment in proper working order. The Contractor shall identify calibration needs and ensure that the necessary factory equipment calibrations for the MetLab equipment are kept up to date. The Contractor shall maintain a record of all maintenance activities. Whenever practically possible the calibration data for this equipment shall include National Institute of Standards and Technology (NIST) traceable information.

Task 2. MetLab Operations

(1) The Contractor shall implement a "Work Request Form" to conform to ISO 17025 and the GUM requirements. The Contractor shall insure that the information is correct for the Division, Branch, Office location, Name and Phone number for each requestor. The Contractor shall retain a copy of each request via hard copy or digital copy.

(2) The Contractor shall perform measurement device and equipment calibrations that conform to ISO 17025 and the GUM. The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WAM shall be notified and then provide technical direction to the contractor for prioritization. The Contractor shall maintain a record and data base of all equipment calibrations and calibration schedules.

(3) The Contractor shall develop, document, and implement detailed calibration operating procedures for all laboratory calibration services.

(4) The Contractor shall assemble and maintain a system of published procedures and product information relevant to calibration measurement procedures and measurement devices.

Task 3. Validation of Procedures and Calibration Tracking System

The Contractor shall confirm the current acceptable validation methods for all calibration systems used in the MetLab and also for the calibration tracking system. Any confirmation of validation methods should be documented. All database functions that are user-programmed shall be tested and the validation documented. Each revision to the database software (exclusive of the data in the database) shall have an identifiable revision number assigned to it.

Task 4. Metrology Quality Assurance Laboratory Support for NHEERL Ambient Air Standards Certification

The Contractor shall perform measurement device and equipment calibrations that conform to the NHEERL Calibration SOPs or ISO 17025 and the GUM. Some of these devices will be carried to the MetLab for calibration. Other devices can not be physically carried to the MetLab facility, therefore the Contractor will need to take portable calibration equipment to the NHEERL Lab to perform the calibration. The Contractor shall maintain a record and data base of all equipment calibrations and calibration schedules. The following devices from NHEERL will be calibrated by the Metrology Lab:

354	balances
24	plate readers
74	pH meters
2	luminometers
26	spectrometers
7	Thermometers
30	mass sets
3000	pipettes

The contractor shall calibrate any other device not on this list as labor hours will allow.

IV. Deliverables (Applies to all Tasks)

The Contractor shall provide the following reports for NHEERL:

(1) Monthly reports of the laboratory support activities including the following:
   a) The number of and type of calibrations performed.
   b) Any costs incurred during calibration activities.
   c) Any maintenance activities performed.
   d) Any documentation activities performed.

(2) Special reports as requested via a Technical Directive by the WAM.

(3) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WAM shall be notified and then provide technical direction to the contractor for prioritization.

(4) The WAM shall be copied on all correspondence to and from any laboratories and vendors used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WAM.

(5) The contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(6) Formatting of reports should be comparable to historical reporting (using the same or very similar format used during the previous year) and electronic files should be compatible with Agency Standard Software, such as MS Excel 2007, MS Word 2007 and Adobe Reader 10.0 or current agency standard software.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-20

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Fate and Transport of RDD

Contractor	Specify Section and paragraph of Contract SOW
ARCADIS U.S., INC.	2.0

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:
Continued project from the option III. The fund (88k) is rolled over from the option III also. Use the PR-ORD-12-03460 and PR-ORD-12-03284.

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Sangdon Lee (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-4531 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature)	3/20/13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Statement of Work

For WA 4-20

Fate and Transport of Radiological Dispersal Device (RDD)

Task: The contractor shall conduct the wash down tests using a pressure washer according to the method described in the QAPP, Assessment of Water Wash Down for Mitigation of Cesium Chloride Contamination PART II Pressure Washing amendment #3, provided by EPA WAM. The contractor shall analyze the concentration of Cs in washdown rinsates and particles from the test coupons using ICP-MS and report the Cs levels to EPA WAM in electronic format.

Project Deliverables for Fate and Transport of RDD:

Deliverables	Date of Completion
Test coupon preparation and data for their dimensions and weights in spreadsheet	**March 31, 2014**
Cs ion concentrations from washdown rinsates and particles	**March 31, 2014**
RH, temperature, and water pressure data in spreadsheet	**March 31, 2014**

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-21

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base X Option Period Number	MODIFICATION AND TESTING OF TR

Contractor	Specify Section and paragraph of Contract SOW
ARCADIS U.S., INC.	Section 2

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Shannon Serre (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3817 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature)	3/21/13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK

MODIFICATION AND TESTING OF TRANSPORTABLE GASIFIER FOR ANIMAL CARCASSES

OMIS DCMD C.4.1.1.3
(APPCD ON-SITE CONTRACT EP-C-09-027)
WA 4-21

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

TABLE OF CONTENTS

I. TITLE
Modification and Testing of Transportable Gasifier for Animal Carcasses

II. PERIOD OF PERFORMANCE
The period of performance for the work under this work assignment shall be Award – 3/31/14.

III. SUMMARY OF OBJECTIVES
The objective of this work assignment is to make repairs and modifications to the gasification system, and to run an appropriate Proof of Concept test on swine and poultry in a real world scenario.

IV. RELEVANCE
A comprehensive response strategy is required to effectively mitigate animal health emergencies (i.e. high –consequence foreign animal diseases) and maintain continuity of business to the maximum extent practicable. This response strategy must incorporate plans and technologies for rapid depopulation, decontamination, and disposal of affected animals. This technology could be used as a disposal option for animal carcasses following a disease outbreak.

V. BACKGROUND
This project is a combined effort between the Environmental Protection Agency (EPA) and the Department of Homeland Security (DHS). EPA and DHS are committed to using cutting edge technologies and scientific talent in our quest to make America safer.

A comprehensive response strategy is required to effectively mitigate animal health emergencies (i.e. high –consequence foreign animal diseases) and maintain continuity of business to the maximum extent practicable. This response strategy must incorporate plans and technologies for rapid depopulation, decontamination, and disposal of affected animals. Current response strategies which rely on stop-movement orders, quarantine, depopulation, carcass disposal, and limited application of available vaccines, are inadequate to meet the logistical challenges of large and/or multifocal outbreaks. Furthermore, these response efforts fail to manage or mitigate the psychological, social, economic, trade, social, or environmental consequences. There is a critical need to develop new and/or enhanced animal health emergency response strategies, tools, and technologies in order to increase capacity and to ensure that depopulation, decontamination, and disposal (3D) activities are handled as rapidly and as humanely as possible.

During the past five years, an interagency team, including USDA, the EPA, the Department of Defense (DoD), and the North Carolina Department of Agriculture and Consumer Services (NCDA&CS) has been collaborating on a project managed by the DoD's Technical Support Working Group (TSWG), involving the poultry and swine industries, to develop a technology to dispose of animal carcasses resulting from disease or natural disaster by mobile maceration and thermal gasification.

Early tests showed promise in a prototype equipment package designed and constructed to process 25 tons or more of swine or poultry carcasses in a day, with the system being expandable with multiple units to process up to 200 tons or more of carcasses daily. Initial field testing of the prototype indicated that many of the design requirements were successfully met and tested, but some design flaws in the prototype created limitations in achieving the desired feed rate.

This Scope of Work describes an effort to make needed repairs and modifications to the system, and to run an appropriate Proof of Concept test on swine and poultry in a real world environment. Such technology would provide the basis for strategically placed gasifier units around the country that could respond to diseases or disaster in a timely manner and provide an environmentally sound carcass disposal option.

With repair, enhancement, modification of the prototype system and effective training of an operating staff, the macerator and gasifier system should be able to safely process 25 tons or more of poultry or swine carcasses per day. The current prototype does not have the capability of processing large animal carcasses such as bovine or equine due to cost savings achieved on the macerator purchase that is with

the unit. The addition of a pre-breaker would enable large animals to be processed. Another important note is that the macerator unit is on a self-contained trailer and could be used in conjunction with other large-scale technologies that DHS might be interested in developing and testing.

The prototype is currently located in Wallace, North Carolina. Although some of the components (e.g., generator) have received routine maintenance, there has been some deterioration of some components due to the unit having not been operated for an extended period of time.

VI. SCOPE

The existing gasifier prototype shall be repaired to restore the components that are not being replaced in the activities of other tasks to their functional state. This shall include repair of the outer shell, refractory, ash discharge auger, trailers, control system, door assemblies, electrical components, generator, macerator, and feed system. All repairs shall be documented using Computer Aided Design (CAD) tools and all revised design drawings shall be collected into a system documentation manual in both electronic and hard copy form.

VII. TECHNICAL APPROACH

This is a follow on work assignment from the previous option period. A plan has been developed on how to proceed with the modification of the gasifier system. A list of suggested repairs shall be submitted by the contractor to the EPA WAM for consideration prior to initiating any repairs. Written authorization will be provided by WAM on repairs that shall be completed. Once the repairs have been completed a series of shakedown tests shall be planned based on discussions between the EPA WAM and the contractor.

VIII. AFFORDABILITY

This effort is labor intensive, which is where the bulk of the funding is required. The contractor shall determine which materials are necessary to repair the gasifier. Large capital equipment items will be procured by the EPA with smaller items being procured by the contractor. The unit is currently located in Wallace, NC and moving all the components of the unit is not financially feasible, so it may be necessary to subcontract with someone in the Rose Hill area to assist in repair/upgrade of the unit.

IX. TECHNICAL RISK

The technical risk involved in this project is minimal. The ultimate goal is to test the throughput operation of the gasifier using swine and poultry.

X. FACILITIES AND MATERIALS

All experimental efforts shall be performed by the contractor in Rose Hill, NC. If deemed feasible, the gasifier unit may be moved to Research Triangle Park, NC for repairs if the contractor and WAM decide this is the most feasible way to repair the unit.

XI. TASKS

The following tasks are defined as part of this work assignment:

Task 1: Repair the damaged and deteriorated components of the gasifier prototype

The existing prototype shall be repaired to restore the components that are not being replaced in the activities of other tasks to their functional state. This shall include repair of the outer shell, refractory, ash discharge auger, trailers, control system, door assemblies, electrical components, generator, macerator, and feed system. All repairs shall be documented using Computer Aided Design (CAD) tools and all revised design drawings shall be collected into a system documentation manual in both electronic and hard copy form.

Task 2: Replace the oil-fired burners and associated equipment with gas-fired burners

The initial design decision to use oil-fired burners, although noble in its intent of minimizing logistics associated with fuel delivery by having the generator and burners use the same fuel, resulted in significant operational difficulties, including difficulty igniting, poor turndown ratios, and unreliable operation. The unit will be refitted with gas burners that burn LP or natural gas, and associated piping, fuel delivery, flame safety, and process control hardware. All new equipment installations will be

documented using Computer Aided Design (CAD) tools and all revised design drawings will be collected into a system documentation manual in both electronic and hard copy form.

Task 3: Modification of the feed system

The initial feed system design required manual actuation of the feeding valves from the top of the gasifier to distribute the feed onto the gasifier's hearth. The initial feed system also had a side effect that a volume of material equal to the amount of material fed into the macerator was introduced onto the hearths. This required paying significant attention to the introduction of material into the macerator, and caused operational difficulties when large animals were fed into the macerator. The feeding system shall be redesigned to decouple the quantity of material fed into the macerator from the quantity of material distributed onto the gasifier's hearth. In addition, the material transport system shall be re-evaluated to potentially use an auger rather than a pump. In addition, the control of the valves to distribute the feed across the gasifier hearths shall be automated with a manual override at ground level. The feed system shall be able to operate under negative draft to reduce the potential of contamination via aerosols escaping the system. All new equipment installations shall be documented using Computer Aided Design (CAD) tools and all revised design drawings shall be collected into a system documentation manual in both electronic and hard copy form.

The feed system shall also include a mechanism to distribute the feed material across the hearth. One design that has been discussed is a raking mechanism that can distribute the material and push the ash toward the ash auger.

A pre-breaker shall be added to the system and shall utilize the existing pump to the extent that it is possible. The pre-breaker will be used to handle larger animals such as bovine. The contractor shall evaluate whether the existing macerator is needed or whether the pre-breaker can be used as a standalone size reduction mechanism. The contractor shall submit the recommendation to the EPA WAL for a final decision before purchasing.

This follow-on work assignment assumes that the fabrication of the feed system was completed as part of WA 3-21.

Task 4: Develop training materials for operational personnel

Training materials shall be developed for operational personnel to encompass mobilization, field assembly, operation, cleaning, maintenance, repairs, troubleshooting, and demobilization. Training materials shall be delivered in both hard copy and electronic forms.

Task 5: Evaluate and modify control system for the macerator and gasifier

The electrical system, control system, and associated equipment shall be tested and modified (if necessary) to assure that the gasifier can operate safely from a suitable location in all weather conditions. All new equipment installations shall be documented using Computer Aided Design (CAD) tools and all revised design drawings shall be collected into a system documentation manual in both electronic and hard copy form.

Task 6: Shakedown Testing

Once the modifications and repairs have been completed, the project operating team shall conduct a series of shakedown tests to optimize the performance of the unit, properly adjust the system, train personnel to safely and reliably operate it in the field, and perform at the highest throughput possible. Information shall be used to develop and design operations, maintenance, repair, assembly, disassembly and transportation material for reference and training. A Quality Assurance Project Plan shall be developed and approved, prior to any testing, to address any measurements to be taken as a part of this testing.

As part of this testing a Health and Safety Protocol (HASP) prior to any shakedown or throughput testing. The contractor shall provide a copy of the HASP to the EPA WAL so that the WAL can file with the ORD-SHEM office.

Task 7: Maximum Throughput Continuous Operation Test

The contractor shall carry out and document a three-day Proof of Concept (PoC) test at the highest throughput safely possible. It is anticipated that a 72 hour continuous test shall be required as part of this task. Upon completion of the test, the contractor shall clean and disinfect the equipment and test area, and prepare the system for relocation. The contractor shall prepare an After Action Report (AAR) based on the project activity and the results of the test. A Quality Assurance Project Plan shall be developed and approved, prior to testing, to address any measurements to be taken as a part of this testing.

Task 8: Modification of the macerator system

Upgrade of the processing macerator capability for bovine and equine carcasses by the addition or incorporation of a pre-breaker and associated infrastructure and transporting systems shall be required. The contractor shall recommend the required components and shall install these components as part of this task. Depending on budgetary constraints this Task will receive the lowest priority out of all the Tasks for this work assignment. All new equipment installations shall be documented using Computer Aided Design (CAD) tools and all revised design drawings will be collected into a system documentation manual in both electronic and hard copy form.

Task 9: Documentation

As part of this task, the contractor shall evaluate and document the system, its operation, required maintenance, performance, and any other modifications or improvements. All new equipment installations shall be documented using Computer Aided Design (CAD) tools and all revised design drawings shall be collected into a system documentation manual in both electronic and hard copy form. A complete set of all of this documentation shall be placed with the unit in a weather protected container and provided to the project officer. It is anticipated that a total of 5 sets of documentation shall be provided.

Task 10: Clean, Decontaminate, Disassemble, Secure for Transport

The contractor shall clean, decontaminate, disassemble, and securely package the gasifier system, including macerator, for transport to a location identified by the North Carolina Department of Agriculture and Consumer Services for staging. If the Contractor does not have the capacity to transport the system once it is packaged, a heavy rigging/trucking company shall be hired by the contractor to transport and unload the system at the designated location. The location is anticipated to be in the Raleigh, NC area.

XII. DELIVERABLE SCHEDULE

- On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, quarterly and cumulative financial expenditures and cost and schedule variance.

- A draft report shall be delivered to the EPA WAM within 6 weeks of the conclusion of Task 8.

Deliverable Schedule

Deliverable	Date
QAPP/Test Plan	1 month prior to beginning Task 6
Data summaries	On-going
Draft Report	6 weeks after conclusion of Task 7
Final Report	4 weeks after receiving comments from EPA

XIII. REPORTING REQUIREMENTS

- The Contractor shall prepare Quality Control data reports of all facility-specific data. Each Quality Control report shall be in a format suitable for EPA/NHSRC publication and shall discuss how well various measurements described in the QA plan were met.
- The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The contractor shall prepare a QAPP in accordance with

http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.

- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.
- All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

NHSRC QUALITY ASSURANCE REQUIREMENTS FORM
Attachment 1 to the Statement of Work

I GENERAL INFORMATION

Title:	Modification and Testing of Transportable Gasifier for Animal Carcasses
Description:	Modification and Testing of Transportable Gasifier for Animal Carcasses
Project ID:	C.4.1.1.4
Status:	Original
Number Ammended:	
QA Category:	III
Action Type:	Extramural
Peer Review Category:	III
Security Classification:	Unclassified
Project Type:	Applied Research
QAPP Status 1:	Not Delivered
Vehicle Status:	Existing Vehicle
Vehicle Type:	Vehicle Number: EP-C-09-027 Work Assignment Number: 4-21 Delivery/Task Order Number: n/a Modification Number: n/a Other:

*If you are processing an **IAG** or **CRADA**, the responsibility for QA must be negotiated within the agreement. The TLPs in consultation with the QAMs in the various organizations must agree on, and document, which organization will take the lead for QA, the names of the QAM and TLP from each organization, and the QA requirements that will be adhered to during the agreement. Include this info in the IAG/CRADA package.*

II SCOPE OF WORK

Yes — Does the Statement of Work contain the appropriate QA language?

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with the R-2 and R-5 and/or the attachments provided with the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf

Yes — Does this extramural action involve the collection, generation, use, and/or reporting of environmental data; the design, construction, and operation of environmental technologies; or development of software, models, or methods?
(If "No" then skip to Section IV, and sign the form.)

No — Will the SOW or any subsequent work assignments or task orders involve any cross-organizational efforts within EPA?

No — Has a QAPP already been approved for the activities specified in the SOW?

Is an applicable QAPP in the process of being prepared, revised, or approved by EPA personnel for future use

Yes

by the contractor? (QA approval must be obtained before the contractor can start work.)

Provide the exact title for submission to QA staff for approval:

Modification and Testing of Transportable Gasifier for Animal Carcasses

Provide the approximate date for submission to QA staff for approval:

05/01/2013

III QA DOCUMENTATION OPTIONS

All documentation specified under "Other" must be defined in the NHSRC Quality Management Plan and be consistent with requirements defined in EPA Manual 5360 A1. For all items checked below, there must be adequate information in the SOW (or its appendices) for the offeror to develop this documentation. Where applicable, reference a specific section of the SOW. *(R-2 refers to EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, 03/20/01) and R-5 refers to EPA Requirements for Quality Assurance Project Plans (QA/R-5) (EPA/240/B-01/003, 03/20/01). Copies of these documents are available at http://www.epa.gov/quality/qa_docs.html)*

After Award Documentation

Not Applicable	Documentation of an organization's Quality System. QMP developed in accordance with:
Not Applicable	Combined documentation of an organization's Quality System and application of QA and QC to the single project covered by the contract: Developed in accordance with:
Other	Documentation of the application of QA and QC activities to applicable project(s). Developed in accordance with:
	Explain: The QAPPs shall be developed in accordance with the attachment #1 (QAPP requirements for applied research projects)
n/a	Programmatic QA Project Plan with supplements for each specific project, developed in accordance with:
Documentation will be identified in individual Statements of Work	Existing documentation of the application of QA and QC activities will be used:

IV SIGNATURE BLOCK

The signatures below verify that the Statement of Work (SOW) has been reviewed to ascertain the necessary QA and QC activities required to comply with EPA Order 5360.1 A2, that the COR understands these requirements, and that the COR will ensure that the quality requirements indicated on the previous pages of this form are incorporated into all associated SOWs. *(Sign/date below, obtain a concurrence signature from the QA Staff, and submit the form along with the other extramural action documentation.)*

Shannon Serre NHSRC-IO Technical Lead Person	02/21/2013 Date	Ramona Sherman 02/25/2013 Ramona Sherman NHSRC-IO QA Staff Member	02/25/2013 Date

QAPP REQUIREMENTS FOR APPLIED RESEARCH PROJECTS

(from Appendix B of the NHSRC QMP)

An applied research project is a study to demonstrate the performance of technologies under defined conditions. These studies are often pilot- or field-scale. The following requirements should be addressed as applicable.

SECTION 0.0, APPROVAL BY PROJECT PARTICIPANTS

The EPA Technical Lead Person (TLP) shall be responsible for obtaining signatures of appropriate project participants on the signature page of the QA plan, documenting agreement to project objectives and the approach for evaluating these objectives.

A distribution list shall be provided to facilitate the distribution of the most recent current version of the QAPP to all the principal project participants.

SECTION 1.0, PROJECT DESCRIPTION AND OBJECTIVES

1.1 The purpose of study shall be clearly stated.

1.2 The process, site, facility, and/or environmental system to be tested shall be described.

1.3 Project objectives shall be clearly stated and identified as primary or non-primary.

SECTION 2.0, PROJECT ORGANIZATION

2.1 Key points of contact for each organization involved in the project shall be identified.

2.2 All QA Managers and their relationship in the organizations (*i.e.*, location within each organization) shall be identified with evidence that the QA Manager is independent of project management.

2.3 Responsibilities of all other project participants and their relationship to other project participants shall be identified, meaning that organizations responsible for planning, coordination, sample collection, sample custody, measurements (*i.e.*, analytical, physical, and process), data reduction, data validation, and report preparation shall be clearly identified.

SECTION 3.0, EXPERIMENTAL APPROACH

3.1 The general approach and the test conditions for each experimental phase shall be provided. The statistical methods that will be used to evaluate the data (*i.e.*, ANOVA, or summary statistics) should be identified.

(NOTE: As deemed appropriate to the project by the TLP, the information requested in Sections 3.2, 3.3, and 3.4 may be presented here or in Section 4; the information requested in Sections 3.5 may be presented here or in Section 5; and the information requested in Sections 3.6 may be presented here or in Section 7.)

3.2 The sampling strategy shall be included and evidence must be presented to demonstrate that the strategy is appropriate for meeting primary project objectives, *i.e.*, a description of the statistical method or scientific rationale used to select sample sites and number of samples shall be provided.

3.3 Sampling/monitoring points for all measurements (*i.e.*, including locations and access points) shall be identified.

3.4 The frequency of sampling/monitoring events, as well as the numbers for each sample type and/or location shall be provided, including QC and reserve samples.

3.5 All measurements (*i.e.*, analytical [chemical, microbiological, assays], physical, and process) shall be identified for each sample type or process, and project-specific target analytes shall be listed and classified as critical or noncritical in the QAPP.

3.6 The planned approach (statistical and/or non-statistical) for evaluating project objectives shall be included.

SECTION 4.0, SAMPLING PROCEDURES

4.1 Whenever applicable, the method used to establish steady-state conditions shall be described.

4.2 Known site specific factors that may affect sampling/monitoring procedures shall be described.

4.3 Any site preparation needed prior to sampling/monitoring shall be described.

4.4 Each sampling/monitoring procedure to be used shall be discussed or referenced. If compositing or splitting samples, those procedures shall be described.

4.5 For samples requiring a split sample for either QA/QC purposes or for shipment to a different laboratory, the QAPP shall identify who is responsible for splitting samples, and where the splitting is performed (*e.g.*, field versus lab).

4.6 If sampling/monitoring equipment is used to collect critical measurement data (*i.e.*, used to calculate the final concentration of a critical parameter), the QAPP shall describe how the sampling equipment is calibrated, the frequency at which it is calibrated, and the acceptance criteria for calibration or calibration verification as appropriate.

4.7 If sampling/monitoring equipment is used to collect critical measurement data, the QAPP shall describe how cross-contamination between samples is avoided.

4.8 The QAPP shall include a discussion of the procedures to be used to assure that representative samples are collected

4.9 A list of sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis, shall be specified.

4.10 Containers used for sample collection, transport, and storage for each sample type shall be described.

4.11 Describe how samples are uniquely identified

4.12 Sample preservation methods (*e.g.*, refrigeration, acidification, *etc.*), including specific reagents, equipment, and supplies required for sample preservation shall be described

4.13 Holding time requirements shall be noted

4.14 Procedures for packing and shipping samples shall be described

4.15 Procedures to maintain chain of custody (*e.g.*, custody seals, records) during transfer from the field to the laboratory, in the laboratory, and among contractors and subcontractors shall be described to ensure that sample integrity is maintained

4.16 Sample archival requirements for each relevant organization shall be provided

SECTION 5.0, TESTING AND MEASUREMENT PROTOCOLS

5.1 Each measurement method to be used shall be described in detail or referenced Modifications to EPA approved or similarly validated methods shall be specified.

5.2 For unproven methods, verification data applicable to expected matrices shall be included in the QAPP meaning the QAPP shall provide evidence that the proposed method is capable of achieving the desired performance

5.3 For measurements which require a calibrated system, the QAPP shall include specific calibration procedures applicable to each project target analyte, and the procedures for verifying both initial and continuing calibrations(including frequency and acceptance criteria, and corrective actions to be performed if acceptance criteria are not met).

SECTION 6.0, QA/QC CHECKS

6.1 At a minimum, the QAPP shall include quantitative acceptance criteria for QA objectives associated with accuracy, precision, detection limits, and completeness for critical measurements (process, physical, and analytical, as applicable) for each matrix.

6.2 Any additional project-specific QA objectives shall be presented, including acceptance criteria. This includes items such as mass balance requirements.

6.3 The specific procedures used to assess all identified QA objectives shall be fully described

6.4 The QAPP shall list and define all other QC checks and/or procedures (*e.g.*, blanks, surrogates, controls, *etc.*) used for the project, both field and laboratory.

6.5 For each specified QC check or procedure, required frequencies, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met shall be included

SECTION 7.0, DATA REPORTING , DATA REDUCTION , AND DATA VALIDATION

7.1 The reporting requirements (*e.g.*, units, reporting method [wet or dry]) for each measurement and matrix shall be identified

7.2 The deliverables expected from each organization responsible for field and laboratory activities shall be listed

7.3 Data reduction procedures specific to the project, and also specific to each organization, shall be summarized.

7.4 Data validation procedures specific to each organization used to ensure the reporting of accurate project data to internal and external clients shall be summarized.

7.5 Data storage requirements for each organization shall be provided

7.6 The product document that will be prepared for the project shall be specified(*e.g.*, journal article, final report, *etc.*). The contents of this document can be referenced to a NHSRC or program-specific QMP, if appropriate.

SECTION 8.0, ASSESSMENTS

8.1 The QAPP shall identify all scheduled audits (*i.e.*, both technical system audits [TSAs] and performance evaluations [PEs]) to be performed, who will perform these audits, and who will receive the audit reports.

8.2 The QAPP shall provide procedures that are to be followed that will ensure that necessary corrective actions will be performed

8.3 The responsible party(-ies) for implementing corrective actions shall be identified

SECTION 9.0, REFERENCES

References shall be provided either in the body of the text as footnotes or in a separate section

Attachment # 2

NHSRC QA
To the Statement of Work
Requirements/Definitions List

EPAs Quality System Website: http://www.epa.gov/quality
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html
EPA's Quality System Website: http://www.epa.gov/quality/qs-docs/r5-final.pdf

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

NHSRC QA Requirements/Definitions List
Category Level Designations (determines the level of QA required):

☐ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP: QAPP** requirements for the specific project type (see below).

☐ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP QAPP** requirements for the specific project type (see below).

Project Types:

These outlines of NHSRC's QAPP Requirements for various project types, from Appendix B of the NHSRC QMP (except where otherwise noted), are condensed from typically applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These lists and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

☐ **Applied Research Project** - pertains to a study performed to generate data to demonstrate the performance of accepted processes or technologies under defined conditions. These studies are often pilot- or field-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Applied Research Projects" from Appendix B of the NHSRC QMP.

☐ **Basic Research Project** - pertains to a study performed to generate data used to evaluate unproven theories, processes, or technologies. These studies are often bench-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Basic Research Projects" from Appendix B of the NHSRC QMP.

☐ **Design, Construction, and/or Operation of Environmental Technology Project** - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" G-11, at [illegible]. For additional information, you may refer to Part C of "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology," ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995.

☐ **Geospatial Data Quality Assurance Project** - pertains to data collection; data processing and analysis; and data validation of geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" G-5S at [illegible]

☐ **Method Development Project** - pertains to situations where there is no existing standard method, or a standard method needs to be significantly modified for a specific application. The QAPP shall address all requirements listed in "QAPP Requirements for Method Development Projects" from Appendix B of the NHSRC QMP.

☐ **Model Development Project** - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" G-5M at [illegible]

☐ **Sampling and Analysis Project** - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information. The QAPP shall address all requirements listed in "QAPP Requirements for Sampling and Analysis Projects" from Appendix B of the NHSRC QMP.

☐ **Secondary Data Project** - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. The QAPP shall address all requirements listed in "QAPP Requirements for Secondary Data Projects" from Appendix B of the NHSRC QMP.

☐ **Software Development and Data Management Project** - pertains to software development, software/hardware systems development, database design and maintenance, data validation and verification systems. The QAPP shall address all requirements listed in "QAPP Requirements for Software Development Projects" from Appendix B of the NHSRC QMP.

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality

assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r2-final.pdf.

R-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r5-final.pdf.

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Technical Lead Person (TLP) - This person is technically responsible for the project. For extramural contract work, the TLP is typically the contracting officer's representative (COR). For intramural work, the TLP is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
NRMRL	National Risk Management Research Laboratory	QAM	Quality Assurance Manager
QA ID	Quality Assurance Identification	QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan	SOW	Statement of Work
QS	Quality System	CRADA	Cooperative Research & Development Agreement
TLP	Technical Lead Person		

Attachment #2 to the Statement of Work
Revision 1, March 2006
NHSRC 06/02

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-23

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Combustion Emissions and Expos

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

[ ] Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Bill Linak (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-5792 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 5/6/13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Scope of Work WA 4-23

Combustion Emissions and Exposure Support

This WA contains tasks to generate, collect, and characterize particulate matter (PM) and other pollutants from stationary combustion sources burning fossil fuels (coals, fuel oils, gasoline, petro-diesel) and biofuels (wood, glycerol, ethanol, bio-diesel). Portions of this work are being conducted in collaboration with students, post doctoral researchers, and NERL and NHEERL investigators to perform chemical characterization and exposures and collect particle and gas-phase emissions for health studies. The scope includes support activities to assemble, operate and maintain research facilities and instrumentation, as well as support data collection, health and safety, and quality assurance efforts. Task 1 describes the general efforts to generate, collection, and characterize combustion emissions from various combustion devices and fuels for use in aging and exposure studies. Tasks 2 describe a specific project to examine the behavior of metal fuel borne catalysts in diesel engines.

The contractor shall perform the following tasks:

Task 1. Combustion Emissions – Generation, Collection, Physical and Chemical Characterization

Background

Combustion particles are ubiquitous ambient air contaminants derived from a large variety of mobile and stationary sources. Exposure to combustion PM is associated with carcinogenic and immunotoxic effects in humans and experimental animals. At the cellular level, these health effects are underlain by genotoxic and inflammatory properties of chemical compounds present in the PM. Combustion PM is composed of elemental, inorganic and organic compounds that vary widely in composition with the source of the fuel, combustor/boiler/engine operating conditions, sampling methods and other parameters. The genotoxic and inflammatory potencies of combustion PM also vary with its physicochemical properties, and these differences along with multiple health effects impede the development of targeted regulatory strategies for mitigating the impact of combustion PM exposure on human health. Combustion emissions shall be generated, and PM samples shall be collected using a number of fuels, fuel mixtures, fuel additives, combustor/boiler/engine types, operating conditions, and collection techniques. These PM samples shall then be stored and characterized through extensive chemical and physical analyses. In conjunction with the chemical and physical analyses (described above), whole particles and extracts shall be provided to NHEERL investigators for subsequent determination of inflammogenic and genotoxic potencies.

Objectives / Scope of Work

The objectives of this WA task are to generate, characterize, and collect a number of combustion emission samples with different physical, chemical, and toxicological properties, and (in conjunction with NERL and NHEERL investigators) and correlate differences in these properties with adverse health effects and mechanisms of toxicity. Experiments may include emission aging experiments utilizing a new mobile atmospheric aging chamber.

Combustion emission samples shall be analyzed for composition particle size and morphology during production while detailed chemical analysis shall be performed post-collection. Physical measurements shall include particle size distributions using a scanning mobility particle sizer (SMPS) and an aerodynamic particle sizer (APS). Particle concentrations shall be assessed with gravimetric filters and TEOM instrumentation. Particle morphology shall be examined by scanning and transmission electron microscopy. Chemical analysis shall involve qualitative analysis by aerosol time of flight mass spectroscopy (ATOF-MS), quantification of elemental and organic carbon (OC/EC), inorganic trace element analysis by x-ray fluorescence (XRF) and inductively coupled plasma-mass spectroscopy (ICPS). Additional samples shall be subjected to solvent extraction with dichloromethane (DCM), and then sequential fractionation using hexane, 50% hexane/50% DCM, DCM, and methanol to determine the relative concentrations of polar and

non-polar compounds. Extract mass shall be determined gravimetrically. Organic extracts shall be further analyzed using gas chromatography in conjunction with mass spectroscopy (GC-MS) in the full scan mode. Acquired spectra shall be searched against a computerized mass spectral library and shall also be reviewed manually. Standards of both PAHs and nitro-PAHs shall be analyzed and semi-quantitative values shall be obtained by comparing area ratios of any particular peak to the internal standard. Approximately 25 peaks shall be examined and emphasis shall be placed on those peaks that appear to differ between the samples. Since many of the more polar compounds may not be detected by the GC-MS because of their volatility, high performance liquid chromatography in conjunction with Ion Trap Mass Spectroscopy (LC-MS) shall be performed. In addition to organic analysis, PM samples may be characterized by electron paramagnetic resonance (EPR) analysis for presence and concentration of stable free radical species.

Deliverables

The contractor shall deliver raw analytical data (computer files and data sheets) and reduced data in the form of Excel spreadsheets, pie charts, and graphs of the data collected for each PM sample.

Task 2. Metal Fuel Borne Catalysts for Soot Reduction in Diesel Engines

Background

Metal-based catalysts are added to diesel fuels with the intention of increasing fuel economy and reducing emissions. These fuel borne catalysts (FBCs) are divided into a class of liquid-phase organo-metallic materials that form nano-scale particles during the combustion process, and a class of solid-phase nano-scale metal oxides that are added to fuel and kept in suspension with surfactants. Commercially available formulations include (but are not limited to) compounds containing iron (Fe), platinum (Pt), and cerium (Ce).

While studies have shown that metal FBC additives reduce particle mass emissions, there is also evidence that they increase particle number emissions and otherwise affect the physical and chemical characteristics of diesel exhaust emissions and may result in increased levels of some air toxic chemicals such as benzene, 1,3-butadiene, acetaldehyde. Unless the use of metal FBCs is done in conjunction with diesel particulate filters (DPFs) their use will likely increase the ambient emissions of these metals. Research questions include to what extend do metal FBCs affect diesel related particulate and air toxics emissions (especially in the ultrafine size range <100 nm), and the potential health effects associated with the large-scale application of metal FBCs.

Objectives / Scope of Work

The objectives of this WA task are to operate and maintain two existing experimental facilities designed to examine emissions from combustion with metal FBC additives. These include a Burke-Shumann diffusion flame experiment designed to examine metal FBCs applied to sooting gaseous fuels (ethylene) and a small diesel engine gen-set with controlled dilution designed to examine metal FBCs in engines. Improvement to the existing facilities and development of new experimental capabilities are anticipated. The objectives of this research are to support the design and execution of parametric studies to characterize the physical and chemical properties of gas and particle emissions with and without metal FBCs (Fe, Pt, and Ce). This study may also take advantage of the existing animal exposure facility, and collaboration with NHEERL investigators to perform animal exposure experiments, and collect appropriate samples for instillation studies.

Combustion emission samples shall be analyzed using techniques similar to those identified in Task 1.

Deliverables

The contractor shall deliver raw analytical data (computer files and data sheets) and reduced data in the form of Excel spreadsheets, pie charts, and graphs of the data collected for each parametric study.

General Support

The contractor shall provide technical support, operating experience, analytical support, and expendable materials to conduct these tests using existing in-house combustion systems or through the fabrication, rental, purchase, or lending of additional combustion equipment as necessary. This support shall include:

1. The contractor shall provide expendable materials and building supplies to modify, operate, and maintain the necessary combustion equipment, dilution processing equipment, and sampling equipment as appropriate.

2. The contractor shall provide engineering and operating labor for the design and execution of test plans on these furnaces engines, and dilution systems.

3. The contractor shall maintain, calibrate, and operate monitoring equipment according to APPCD's Recommend Operating Procedures (ROPs), QAPP requirements, safety requirements, and instrument manuals.

4. The contractor shall collect and retain necessary operational data to ensure compliance with NC Air permit reporting requirements.

5. The contractor shall operate and maintain the experimental systems and air pollution control system in full compliance of NC Air permits.

Quality Assurance Project Plans (QAPPs)

The contractor shall perform the activities described in Tasks 1-3 in accordance with the QAPPs entitled:
DEP Collection - QTRAK 04033 9/07
Combustion Particle Analysis - QTRAK 07048 1/09
Generation and Delivery of DEP for Health Effects - QTRAK 98018 8/07
PM Emissions from a Drop Tube Furnace - QTRAK 02062 1/05
Glycerol Combustion – QTRAK 09053 3/12
FBC-DEP Interactions – QTRAK 06035 7/12
The contractor shall revise or amend these QAPPs as needed in accordance with quality assurance requirements. If revisions are necessary, data acquisition shall not commence until official approval is received from EPA Quality Assurance Staff. The contractor shall comply with all requirements as delineated on the "Quality Assurance Review Form" included with this extramural action.

Documentation of Technical Direction

The WAM and contractor's project manager shall schedule weekly project meeting in which task progress, issues, and future direction shall be discussed. The contractor's project manager shall summarize the notes from each of these meetings in the form of an e-mail message to the WAM. This summary shall help assure clear communication, establish project priorities, and provide documentation of technical direction.

Reports of Work

The following reports of work shall be provided.

1. Monthly progress reports with labor costs and ODC charges.

2. Health and safety plans as required by EPA safety officer.

3. The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form" included with this extramural action.

4. Update Facility Manuals as required by EPA QA officer.

5. Operate Compliance reports as required by NC Air permits.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-24

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Intelligent Selection of Sampl

Contractor	Specify Section and paragraph of Contract SOW
ARCADIS U.S., INC.	section 2.0

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:
Intelligent Selection of Sampling Media for Automated Floor Sampling Devices

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name Sangdon Lee (Signature) (Date)		Branch/Mail Code: Phone Number 919-541-4531 FAX Number:
Project Officer Name Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name William Yates William Yates (Signature) 10-22-13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

PERFORMANCE WORK STATEMENT for Intelligent Selection of Sampling Media for Automated Floor Sampling Devices

PURPOSE OF WORK ASSIGNMENT

The goal of this effort is to develop the proof-of-concept for giving Automated Floor Sampling Devices (AFSDs) the ability to identify the surface on which they are moving at any given time. A functional prototype of the surface detection/identification functionality will be produced.

BACKGROUND

One of the successful Science and Technology (S&T) projects done for the Wide Area Recovery and Resiliency Program (WARRP) was the effort to test various automated floor sampling devices (AFSDs) as remote automatic sampling devices for a wide-area anthrax incident. Several off-the-shelf units were tested, with varying degrees of success. The results from these tests are summarized in Table 1. R2 and R4 were the top-performing units in these tests.

Table 1. Results from WARRP Automated Sampling Device Project

AFSD	Model	Cleaning type	Tested Surfaces	Sampling efficiency compared to currently-used methods (%)
R1	Roomba 760	Vacuum with bristle brush	Carpet/ Laminate	26 (carpet)/8.1 (laminate)
R2	XV-11	Vacuum with silicone flat beater	Carpet/Laminate	161 (carpet)/11(laminate)
R3	P3 P4920	Vacuum (no surface agitation tool)	Carpet/Laminate	92 (carpet)/2.5 (laminate)
R4	Mint 4200	Sweep and mop	Laminate	62 (laminate)
R5	Scooba 390	Wet vacuum	Laminate	32 (laminate)

One of the suggested improvements that came from the WARRP effort was to address the issues related to the effectiveness of different types of sampling (e.g., vacuum, wipe) when the AFSD was moving over different types of floor materials. Depending on the porosity and other characteristics of the floor, one type of sampling may be preferable to another type of sampling. The ability to identify the surfaces being sampled in real-time, coupled with the ability to make decisions as to what sampling media to use at that time, would greatly improve the sampling efficiency of AFSDs. The primary motivation for doing this work is to enable the AFSD to dramatically improve its sampling efficiency without requiring any operator input.

Technical Approach:

The goal of this effort is to develop the proof-of-concept for giving the AFSDs the ability to identify the surface on which they are moving at any given time in addition to autonomously sensing the dimensions of the surrounding environment. A functional prototype of the surface detection/identification functionality will be produced. The functional specifications of the prototype will be as follows:

- Ability to detect major types of flooring materials so that sampling decisions can be made; materials to be tested will include: carpet, laminate, wood, and concrete;
- Ability to measure dimensions of the surrounding environment via remote sensing. The resulting measurements shall enable the AFSD to provide a two/three-dimensional (2D/3D) map of the sampled area.
- Small enough to be mounted on the AFSD without affecting normal operations;
- On-board battery to operate the surface detection/identification and remote sensing functionality; and
- On-board data and location acquisition system to log surface identification results for documentation purposes and later analysis.

DETAILED TASK DESCRIPTIONS

Task 1 – Development of a Quality Assurance Project Plan

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The contractor shall prepare a QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. The contractor shall respond to comments on the QAPP from the approval process and provide a final QAPP document. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2 – Set up of Static Test Bed

The contractor shall set up the experimental test bed upon which the initial proof of concept studies will occur. The contractor shall procure equipment for generating sound and light pulses and directing them towards the surface being interrogated. The contractor shall also procure the necessary equipment capable of capturing object distance and resulting room dimensions via remote sensing (e.g., infrared light, LiDAR, etc.). The test bed shall be capable of sampling multiple surfaces, including carpet, concrete, and laminate flooring; determining sample location; and mapping the surrounding environment. The contractor shall procure equipment for acquiring the reflected sound and light pulses from the surfaces being interrogated; equipment for acquiring room measurements; and transferring the measurements to the computer data acquisition system. The LabVIEW code for processing the digital signals and location data will be developed by EPA personnel and installed onto the data acquisition system.

Task 3 – Perform DSP Calibration Experiments on Static Test Bed

The contractor shall perform a series of experiments on the static test bed as per the QAPP (Task 1) to generate results of the reflected sound and light signals as a function of floor material and location being tested. The purpose of these experiments is to develop the information to train the digital signal processing (DSP) software to recognize the surface that is being interrogated. Once the DSP software has been trained, a second series of tests shall be run on the static test bed to verify the operation of the DSP software. This process may require multiple repeats before the DSP software operates acceptably. It is expected that these experiments may take approximately 12 days, two days at a time, followed by a period of data analysis and evaluation.

Task 4 – Perform Remote Sensing Calibration Experiments on Static Test Bed

The contractor shall set up and perform a series of static tests as per the QAPP (Task 1) to map the surrounding environment using equipment capable of capturing object distance and room dimensions using lasers or a comparable technique. The purpose of these experiments is to demonstrate the mapping capability of the hardware/software. This process may require multiple repeats before the room mapping functionality operates acceptably. It is expected that these experiments may take approximately 12 days, two days at a time, followed by a period of data analysis and evaluation.

Task 5 – Set up of AFSD Test Bed

The contractor shall set up the experimental test bed on which these tests will occur. This will include developing materials to construct an area with multiple floor construction materials (e.g., carpet, concrete, laminate) and distinguishable setting as per the QAPP. A data acquisition/control computer shall be acquired and configured with LabVIEW software, along with any necessary LabVIEW add-on packages or 3rd party hardware necessary to perform the work. The LabVIEW software and add-on packages will be supplied by EPA. Multiple AFSDs

will be acquired for the testing as per the QAPP. It is likely that the existing stock of AFSDs from the WARRP project will be suitable for this effort.

Task 6 – Perform Experiments with AFSDs

Based on the results from Task 5, the AFSDs shall be outfitted with devices to produce the audio and/or light pulsing and remote sensing system that was used in the static test bed. The AFSDs shall also be outfitted with mobile data processing equipment to handle the DSP functionality and remote sensing developed in the static test bed. Then, based on the QAPP, a series of tests shall be performed to evaluate the performance of the DSP and mapping functionality on actual AFSDs operating over realistic flooring materials. It is expected that preparation for these experiments shall take 5 days and the experiments themselves shall take approximately 5 days.

DELIVERABLES

1. Planning Meetings and Meeting Notes: The WACOR and contractor's project manager shall arrange project meetings to discuss Task-specific progress, issues, and action items. Where possible the meetings will be run via webinar.

2. Monthly Task Progress and Cost Reports: The Contractor's monthly report to EPA shall summarize work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges.

3. Quality Assurance Project Plans (QAPP): The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The contractor shall prepare a QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.

4. Interim Report(s): The results from Tasks 2 through 6 shall be transmitted to the WACOR as one or more interim memo report(s) for internal distribution (not for external publication).

SCHEDULE

Task	*Deliverable*	*Schedule*
1	QAPP Draft	15 days after issuing WA
1	QAPP Final	15 days after receipt of review comments
2	Set Up of Static Test Bed	15 days after QAPP approval
3-4	Static Test Bed Experiments	December 2013
3	DSP Calibration Experiments	January 2014
4	Remote Sensing Calibration Experiments	January 2014
5	Set Up of AFSD Test Bed	February 2014
6	AFSD Experiments	March 2014
2-6	Final Data Report	March 31, 2014

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-25

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014	
	Base X Option Period Number	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

[ ] Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): [ ]

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Worth Calfee	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-7600 FAX Number: 919-541-0496
Project Officer Name: Kevin Sudderth	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name:	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates	William Yates (Signature)	5-14-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK

DECONTAMINATION OF BUNDLED/BAGGED WASTE WITH pH-ADJUSTED BLEACH

PROJECT# C.4.2.3

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. TITLE

Decontamination of Bundled/Bagged Waste with pH-adjusted bleach

II. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be from date of issuance through March 31, 2014.

III. SUMMARY OF OBJECTIVES

This work shall estimate the efficacy of liquid pH-adjusted bleach-based decontamination approaches for *in situ* treatment of bundled or bagged waste items generated from an indoor office setting. In addition, this effort shall evaluate the occurrence and potential reduction of viable bacterial spores (i.e., effectiveness) as a function of the remediation activities applied within an office or indoor setting. The collateral damage to materials during decontamination procedures will be monitored. The anticipated deliverable will be a step-wise document for on-scene responders and remediation teams providing an option(s) for surface decontamination and in situ waste treatment for responses involving the indoor environment.

IV. RELEVANCE

This project supports the mission of the Decontamination and Consequence Management Division (DCMD) within the U.S. Environmental Protection Agency's (U.S. EPA) National Homeland Security Research Center (NHSRC) by providing relevant information pertinent to the decontamination of contaminated areas resulting from an act of terrorism. The project supports the EPA's Homeland Security Research Program (HSRP) and the NHSRC's strategic goals as described in detail in the Homeland Security Research Multi-year Strategic Plan (draft, November 26, 2008). Specifically, the project is relevant to Long-Term Goal 2 (LTG-2) which states, "The Office of Solid Waste and Emergency Response (OSWER) and other clients use homeland security research program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environments." This project addresses a direct need expressed by OSWER's CBRN Consequence Management Advisory Team (CMAT). In addition, the project is relevant to the U.S. EPA's Office of Pesticide Programs (OPP) crisis exemption process and OPP's regulatory function under Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Due to the potential relevance of this project in preparing for the Federal response to a wide-area anthrax dissemination, this project will be managed by NHSRC with the support of a multidiscipline project team.

V. BACKGROUND

Under Homeland Security Presidential Directive (HSPD)-10, the U.S. Department of Homeland Security (DHS) is tasked to coordinate with other appropriate Federal departments and agencies, to develop comprehensive plans which, "provide for seamless, coordinated Federal, state, local, and international responses to a biological attack." As part of these plans, the U.S. EPA, in a coordinated effort with DHS, is responsible for "developing strategies, guidelines, and plans for decontamination of persons, equipment, and facilities" to mitigate the risks of contamination following a biological weapons attack.

NHSRC provides expertise and products that can be widely used to prevent, prepare for, and recover from public health and environmental emergencies arising from terrorist threats and

incidents. Within NHSRC, DCMD's decontamination research program's goal is to provide expertise and guidance on the selection and implementation of decontamination methods and provide the scientific basis for a significant reduction in the time and cost of decontamination events. The NHSRC's research supports OSWER and OPP. OSWER, through its Special Teams which includes the CBRN CMAT, supports the emergency response functions carried out by the Regional Offices. OPP supports the decontamination effort by providing expertise on biological agent inactivation and ensuring that the use of pesticides in such efforts is done in accordance with FIFRA. Close collaboration between the different program offices having homeland security responsibilities is sought in order to rapidly increase the U.S. EPA's capabilities to help the Nation recover from a terrorist event involving the intentional release of CBR materials. Such collaborations are fostered through efforts such as PARTNER.

In 2001, the introduction of a few letters containing anthrax spores into the U.S. Postal Service system resulted in the contamination of several facilities. Although most of the facilities in which these letters were processed or received in 2001 were heavily-contaminated, they were successfully remediated with approaches such as fumigation with chlorine dioxide or VHP®. It is well agreed that additional quick, effective and economical decontamination methods having the capacity to be employed over wide areas (outdoor and indoor) are required to increase preparedness for such a release.

In addition to fumigation used in primarily, heavily-contaminated facilities, other cleaning methods were used in secondarily contaminated (e.g., cross-contaminated letters potentially in contact with the anthrax spores containing letters or tracked from primarily contaminated sites) areas or primarily contaminated facilities showing a minimal presence of anthrax spores. These methods included combinations of disposal of contaminated items, vacuuming, and the use of liquid sporicides such as a pH-adjusted bleach solution. However, waste disposal was a significant obstacle and cost during most previous anthrax clean-ups. If proven effective, a "lower-tech" approach to decontaminating bagged/bundled waste prior to disposal could reduce overall remediation costs by reducing the amount of waste treatment required off-site by specialized facilities (i.e., medical waste incinerators). Developing and demonstrating lower cost solutions to waste management could significantly increase EPA's readiness to respond to a wide area release.

VI. SCOPE

The purpose of this project is to determine the effectiveness of expedient decontamination procedures when applied to bagged/bundled contaminated waste. Effectiveness will be determined by sampling the waste contents following decontamination. An expedient approach, for the purpose of this effort, is defined as procedures not requiring specialized materials or equipment (i.e., products available at a local hardware store). In addition, similar expedient procedures will be evaluated for their effectiveness at decontaminating an office environment. The office decontamination approach shall include spraying surfaces with sporicidal liquids, bagging and removing waste, and collection of excess liquids pooled following decontamination activities. In this portion of the study, overall effectiveness is a combination of physical and chemical methods to reduce and/or inactivate spores of *B. anthracis* or a relevant surrogate from a contaminated surface. The procedures to be tested are based upon the outcomes from previous

work under EP-C-09-027 WA 0-25 (Part 1), 1-25 (Part 2 and 3), WA 2-25 (Part 4), WA 3-25, and WA 1-35. The methods (procedural steps) and procedures were originally developed based use for the remediation of the wooden shed in Danbury, CT[1] (WA 0-25, 1-25, and 2-25) and via an interagency workgroup on foreign animal diseases threats (WA 1-35).

In Task 1, at least four waste decontamination approaches shall be evaluated for effectiveness. Waste materials typical of indoor office or residential environments shall be selected and included in tests. Waste shall be experimentally contaminated. A subset of waste samples (bags/bundles) shall remain untreated and serve as positive controls. Additional replicate bags/bundles shall be subjected to the decontamination treatment. Appropriate sampling strategies shall be selected, optimized, and utilized to determine the survivorship of *Bacillus* spores following treatment. The purpose of this task is to identify effective and efficient means to decontaminate waste in situ (i.e., on-site, not requiring hazardous transport and treatment at remote, specialized, off-site facilities)

In Task 2, at least two low-tech decontamination approaches shall be evaluated for decontamination effectiveness (surface contamination reduction, as well as presence of waste contamination, rinsate contamination, and aerosol contamination). These approaches are based upon prior experience at the BOTE testing in Idaho. One approach shall involve entry of the contaminated space, "spritzing" and bagging of contaminated porous materials (paper, soft furniture, ceiling tiles, etc), removal (and sampling of waste bags), decontamination of the remaining surfaces by treatment with sporicidal liquids (in accordance with the findings of Task 1), drying (passive or active) of the space, and finally sampling of surfaces. The second approach will be identical, other than no removal of porous items prior to treatment (i.e., all items in the space shall be decontaminated in-place). The purpose of this task is to identify efficient and effective means to decontaminate indoor environments using expedient methods.

The results of both tasks shall be documented in one final report discussing efficacy as a function of independent variables and operational factors associated with each procedure. A draft report shall be provided to the U.S. EPA Work Assignment Manager (EPA WAM) for review and comment. A final report incorporating comments from the EPA WAM, and including a separate documentation of the disposition of comments, shall also be provided as the final deliverable on this work assignment. All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

VII. TECHNICAL APPROACH

The general approach that shall be used to meet the objectives of this project for both tasks is as follows, as briefly mentioned in the Section VI:

- inoculation of the materials with *Bacillus atrophaeus* (formerly, *Bacillus globigii*) spores via aerosol deposition using the procedures developed under EP-C-09-027, WA 0-25 and 1-25 (for 14 in. x 14 in. coupons, and for 4 ft. x 5 ft. coupons), and under EP-C-04-023, WA 4-3 (for 18 mm diameter coupons),
- application of prescribed decontamination methods or procedures;

- assessment of residual viable spores (via post-decontamination sampling), starting inoculation (via sampling of positive controls), and potential cross-contamination (via sampling of negative controls [blanks]);
- analysis of subsequent decontamination procedure residues (e.g., waste, waste water or air samples);
- determination of decontamination effectiveness as measured by log reduction from the test samples compared to positive control samples; and
- documentation of operational considerations (e.g., cross-contamination, procedural time, impacts on materials and personnel).

Decontamination can be defined as the process of inactivating or reducing a contaminant in or on humans, animals, plants, food, water, soil, air, areas, or items through physical, chemical, or other methods to meet a cleanup goal. In terms of the surface of a material, decontamination can be accomplished by physical removal of the contamination or via inactivation of the contaminant with antimicrobial chemicals. Physical removal could be accomplished via *in situ* removal of the contamination from the material or physical removal of the material itself (i.e., disposal). Similarly, inactivation of the contaminant can be done *in situ* or after removal of the material for ultimate disposal. During the decontamination activities following the results of the 2001 anthrax incidents, a combination of removal and *in situ* decontamination was used. The balance between the two was facility dependent and factored in many issues (e.g., physical state of the facility); one factor was that such remediation was unprecedented for the United States Government (USG) and no technologies had been proven for such use at the time. The cost of disposal proved to be very significant and was complicated by the nature of the waste (e.g., finding an ultimate disposal site). Since 2001, a primary focus for facility remediation has been on improving the confidence in *in situ* decontamination methods and evaluating waste treatment options to be able to provide information necessary to optimize the decontamination/disposal paradigm; this optimization has a very significant impact on reducing the cost of and time for the remediation effort.

All sample analysis is outside of the scope of this work assignment. Samples shall be transferred to the on-site Microbiology Lab for analysis under a separate work assignment (EP-C-09-027, WA 4-13).

VIII. AFFORDABILITY

Components of this study are expected to be somewhat labor intensive; the decontamination processes, sampling, and laboratory assays will require extensive human resources. Relative to the labor costs, only a minimal amount of expendable materials are required to be purchased by the contractor for use in this effort.

IX. TECHNICAL RISK

The technical risk involved in this project is thought to be minimal. The purpose of the effort is to provide information pertinent to the development of operational strategies for the decontamination methods included in the study. Hence, all information obtained in this project (whether intended or not) is expected to be significantly relevant to this purpose.

X. FACILITIES AND MATERIALS

All work on this project described in this statement of work (SOW) shall be performed at the U.S. EPA's facilities located at 109 T.W. Alexander Dr., Research Triangle Park, NC. This study shall be conducted in H122A and/or H130A.

XI. TASKS

Prior to initiation of the testing described in the tasks below, a quality assurance project plan (QAPP) shall be provided to EPA for review and comment. After revision based upon EPA comments (as necessary) and approval by EPA, work may commence. Five Category 3/Applied Research QAPPs have been approved by the U.S. EPA for prior testing that have relevance to this effort.

- Assessment of Liquid and Physical Decontamination Methods for Environmental Surfaces Contaminated with Bacterial Spores: Part 1 – Development and Evaluation of the Decontamination Procedural Steps (July 2009)
- Assessment of Liquid and Physical Decontamination Methods for Environmental Surfaces Contaminated with Bacterial Spores: Part 2 – Operational-scale Study of Full Decontamination Procedures (October 2009)
- Application Studies of Biological Agent Decontamination Methods (April 2008)
- Effectiveness of Physical and Chemical Cleaning and Disinfection Methods for Removing, Reducing or Inactivating Agricultural Biological Threat Agents (August 2010)
- Assessment of Liquid and Physical Decontamination Methods for Environmental Surfaces Contaminated with Bacterial Spores: Part 4 – Optimization of method parameters and impact of surface grime (June 2011).

These QAPPs shall be used as the basis for the QAPP for the specific work described in this SOW. The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this work assignment package (see Attachment #1 to the SOW) and the NHSRC QA requirement as defined in Attachment #2 to the SOW. The QAPP, including any amendments, must be approved by the U.S. EPA in writing (e.g., signature on the approval page) prior to the start of any work. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

All test activities shall be fully documented during the activity via narratives in laboratory journals, the use of digital photography and video. This information shall be incorporated into the final report, as warranted to document and convey the findings of this effort. The documentation should include, but not be limited to, record of time required for each decontamination step or procedure, visual observations during the procedures, any deviations from the test plans, physical impacts on the materials, and impacts on the decontamination or sampling personnel.

The technical approach to be used throughout this study shall be developed considering the background information provided in Section V and this section. This study shall be done in two major tasks. The specific details related to these tasks are described below.

Task 1:

Evaluation of waste decontamination procedures

In this task, at least four approaches to bagged/bundled waste decontamination shall be evaluated for effectiveness at reducing the viability of *Bacillus* spores. These evaluations shall occur over 6 tests. A sufficient number of test and control replicates shall be included in the test matrix.

At least three waste material combinations shall be evaluated. At least four unique combinations of decontaminant (i.e., pH-adjusted bleach and Spor-klenz) and decontaminant application (decontaminant application method, frequency, and/or flow rate) shall be evaluated. An example test matrix for Task 1 is outlined in Table 1.

Table 1: Example Task 1 Test Matrix

Test	Decontamination Approach	Material Combination
1	1	1
	2	
2	3	
	4	
3	1	2
	2	
4	3	
	4	
5	1	3
	2	
6	3	
	4	

Task 2:

Evaluation of indoor expedient decontamination approaches

In Task 2, the effectiveness of decontamination procedures shall be evaluated on sections of selected materials. Operational parameters such as processing time, physical impacts on materials or decontamination crew, and fate of the viable spores (e.g., contamination of equipment, wash water, air) shall be determined.

The decontamination procedure to be used in the test matrix is as follows, based upon the results from Task I, and from testing under BOTE, EP-C-09-027, WA 25 and WA 35:

The general decontamination procedures shall be defined as follows:

Decontamination Procedure 1

1. Following contamination, document the items in the room upon initial entry;

2. Spritz (lightly spray to reduce resuspension of spores) all surfaces with pH-AB
3. Bag all loose and porous items, spray contents of bag, then double bag, spray between bags, then seal outer bag and move to waste staging area (WSA);
4. Carpet, ceiling tiles, soft furniture should be sectioned (if necessary) and bagged.
5. All waste should be moved to the WSA prior to surface decontamination treatment;
6. Decontaminate remaining items and all surfaces by spraying with pH-AB. Completely cover all surfaces (spray pattern and speed to be determined by project team);
7. After the required contact time, reenter the room, wet-vacuum all excess water (optional). Enhanced drying procedures may be used between decon and sampling (elevated temperature and/or decreased humidity, and/or increased air flow/exchanges). If wastewater is collected, analyze for viable spores;
8. Sample surfaces for viable spores using sponge stick method;
9. Sample waste bags for viable spores

Decontamination Procedure 2

1. Following contamination, document the items in the room upon initial entry;
2. Spritz (lightly spray to reduce resuspension of spores) all surfaces with pH-AB
3. Decontaminate all items and surfaces by spraying with pH-AB. Completely cover all surfaces (spray pattern and speed to be determined by project team);
4. After the required contact time, reenter the room, wet-vacuum all excess water (optional). Enhanced drying procedures may be used between decon and sampling (elevated temperature and/or decreased humidity, and/or increased air flow/exchanges). If wastewater is collected, analyze for viable spores;
5. Sample surfaces for viable spores using sponge stick method.

The COMMANDER chamber shall be used for this Task. The mock office environment shall be constructed with carpet floors, painted sheetrock walls, drop acoustic ceiling, a desk, chair, and fomites (papers, desktop objects, etc) common to an office environment.

For each test, the COMMANDER chamber shall then be experimentally contaminated with spores of a surrogate organism. The level of surface contamination shall be determined in conjunction with the WAM.

Samples (wipes, sponge stick, vacuum sock, etc) shall be collected prior to (characterization) and following the decontamination procedures. Waste (water, and bagged waste) shall be sampled for viable agent during tests that involve waste removal.

Addition testing details related to Task 2 are as follows:

- The runoff of any liquid (rinsate) applied to the materials shall be collected (wet vac), neutralized, and submitted to the APPCD Microbiology Lab for quantitative viable spore analysis via direct plating. This shall be done by collection of runoff in a sterilized container containing an appropriate amount of neutralizer (e.g., STS). Aliquots of the

runoff shall be taken and filtered (rinsed) for analysis, consistent with the modified approach developed under EP-C-09-027, WA 0-25.

- Rinse water (if needed) shall be confirmed to be free of confounding levels of background contamination prior to the initiation of each test.

- Air samples shall be taken in the decontamination chamber during the decontamination process to indicate the presence of resuspended viable spores. This samples shall be done in accordance with the air sampling described in the approved QAPP entitled, Assessment of Liquid and Physical Decontamination Methods for Environmental Surfaces Contaminated with Bacterial Spores: Part 2 – Operational-scale Study of Full Decontamination Procedures (October 2009)."

- After the decontamination, all surfaces shall be allowed to become visibly dry before being sampled. After at least a period of one day, post-decontamination sampling shall be performed in accordance with the methods prescribed herein and defined in the approved final QAPP.

- All equipment (e.g., brushes, storage bins, etc.) shall be properly sterilized according to the procedures defined in the QAPP prior to the initiation of each test. The procedure is expected to be soaking or washing hard, non-porous materials with a pH-amended bleach solution. Proper decontamination includes selective verification of a representative number of items to be used in a test.

- After completion of each test, the chamber and all contents shall be thoroughly decontaminated with a proven procedure.

- All samples shall be transferred to the on-site Microbiology Lab in sterile primary independent packaging within sterile secondary containment containing logical groups of samples. All samples shall be accompanied by a completed chain of custody form.

- All microbiological analysis for samples described in this SOW shall be performed by the on-site Microbiology Lab. This analysis is outside of the scope of this SOW.

- All tests shall be extensively and adequately photographed and video documented to convey the test procedures.

Table 2: Task 2 Test Matrix

Test	Decon Procedure	Waste Removal	Enhanced Drying before Sampling
1	1	Yes	No
2	2	No	No
3	1	Yes	Yes
4	2	No	Yes
5	TBD	TBD	TBD

Reporting

The contractor shall design an MS Excel data reporting sheet template prior to the start of any work that conveys all relevant information from a test under Task 1 and 2. This template shall be approved by the EPA for use, prior to conducting any testing described in this SOW. All photographs and videos shall be properly documented, indicating the exact tests in which they were taken. A log (in MS Excel) of all photographs and videos shall be maintained with the electronic files. The log shall include a description of each photograph and video, and include the test number and date. All electronic files shall be stored in a project folder set up on the EPA's DTRL share drive. All information relevant to a test (reporting sheet, digital photographs, videos, log file) shall be transmitted to the EPA WAM within 1 week from the completion of the sample analysis. This data shall have been QA/QC'd by the contractor prior to transmission. Transmission shall occur via e-mail to the EPA WAM informing him/her that the data is ready for viewing.

A draft final report detailing the test results and lessons learned from the testing shall be submitted to the EPA WAM within 30 days following the completion of the testing and no later than 2/28/2013. This report shall include documentation of the time required to complete each entire test procedure and all procedural steps. The report shall include any digital photos necessary to illustrate the findings. The draft report shall be submitted by the EPA WAM for review from within EPA, including a Quality Assurance review. A final report incorporating requested changes, correction, and clarification resulting from the review process shall be submitted by the contractor within 15 days from receiving the official comments from the EPA WAM. A separate document detailing the response to comments shall also be submitted to the EPA WAM by the contractor with the final version of the report.

XII. DELIVERABLE SCHEDULE

The deliverables previously described in this SOW with the scheduled due date are shown in Table 3.

Table 3: Deliverable Schedule

Task	Deliverable	Due Date
1,2	Draft QAPP	15 working days after initiation of this Work Assignment
1,2	Final QAPP	10 working days following receipt of EPA comments
1,2	Draft final report	2/15/2014
1,2	Final report	10 working days after receiving comments from EPA

XIII. REPORTING REQUIREMENTS

- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.
- All data related to this project shall be stored on the U.S. EPA servers in the DTRL share folder.

- Data transfer to the EPA WAM shall occur within one week from the completion of data analysis.
- In lieu of final reports for each or any task, journal papers within each task may be submitted at the discretion of the EPA WAM. The papers shall be authored or co-authored by the EPA WAM, at the discretion of the WAM. To serve in lieu of the final report, the journal articles must contain all of the relevant information that would have appeared in the final report.
- All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

XIV. REFERENCES

1. After Action Report – Danbury Anthrax Incident, U.S. EPA Region 1, September 19, 2008.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-26

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base X Option Period Number	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Sangdon Lee (Signature) (Date)	Branch/Mail Code:	
	Phone Number: 919-541-4531	
	FAX Number:	
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code:	
	Phone Number: 919-541-3670	
	FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code:	
	Phone Number:	
	FAX Number:	
Contracting Official Name: William Yates William Yates 10-22-13 (Signature) (Date)	Branch/Mail Code:	
	Phone Number: 513-487-2055	
	FAX Number:	

ssignment Form. (WebForms v1.0)

Development of a Vacuum-based Biological Agent All Surface Sampler
Performance Work Statement

The contractor shall supply the personnel, equipment, and supplies to complete the tasks described below. This Work Assignment (WA) does not constitute an assignment of additional work outside the general scope of the Contract; does not constitute a change as identified in FAR clause 52.243-2 entitled "Changes" nor in any manner causes an increase or decrease in performance or changes any expressed terms, conditions of specifications of the Contract.

1.0 Title

Development of a Vacuum-based Biological Agent Surface Sampling Device

2.0 Summary of Objectives

The proposed work will evaluate options for developing a sampling device that can be used universally on porous and non-porous surface types for collection biological agents. Options for the proposed work include the development of a new surface sampling device that is vacuum-based and includes a liquid dispenser or the development of a new sampling nozzle as described above to augment a COTS device. The ultimate object is to develop a surface sampling device that can be applied to any surface type and could therefore be used in place of all existing devices and methods during the response to a biological incident. Scientifically-testing sampling methods will provide increased confidence in the ability to characterize contamination following such an event.

3.0 Relevance

The product from this work will significantly decrease surface sample collection and analysis time. Currently, there are three surface sampling devices used for biological agents including swabs, wipes, and vacuums fitted with filter-type collection media. Operationally and logistically it is challenging to prepare and utilize these three different collection methods. Furthermore, total sample collection efficiency for each of the three methods range from 12 to 40%. The new sampling device will be operationally and logistically more efficient and total sample collection efficiencies are expected to be higher than existing devices. For the swabs, wipes and vacuums; laboratory processing includes removing the biological agent from the sampling media. During this processing there are agent losses due to inefficiencies. The developed device will not require post-collection processing, as agents are captured directly into a liquid that can be analyzed. As such, the developed method will likely have higher recovery efficiencies than the existing methods. The results of this work will be made available through published reports, journal papers, and/or conference abstracts and presentations.

4.0 Technical Approach

Prototype sampling instruments or alterations to existing sampling equipment shall be made according to input from the Project Team, consisting of members of EPA's Office of Emergency Management, and EPA's Office of Research and Development. The test will determine the proper sampling liquid, liquid amount and sampling procedure. Commercially available devices or laboratory developed and modified sampling devices will be evaluated for collection efficiency through a set of

controlled tests. For example, a known quantity of *Bacillus* spores will be deposited by aerial dispersion onto large coupons (1 $ft.^2$ or greater), constructed of a relevant material type (i.e., carpet). The coupons will then be subjected to vacuum-based sampling, using the device of interest. Recovery will be determined for each sampling device according to culture-based microbiological assays. All test parameters, such as test chamber size, coupon materials and sizes, sampling methods, methods of extraction / analysis will be determined by agreement among participating experts mentioned previously.

5.0 Facilities and Materials

All tasks described in this SOW shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr., unless approved otherwise by the EPA WAM. The sampling activities shall be conducted in the NHSRC's Decontamination Technologies Research Lab (DTRL) located in H-224, H-222, H-122a, and H-130a. The lab contains the necessary equipment for the tasks described herein. The analysis of the biological samples shall be conducted in the Microbiology lab, located in E-386, E-388, and E-390.

6.0 Tasks to be Performed

The contractor shall provide the personnel, equipment, materials, and supplies necessary to perform the following Work Assignment for development of a biological surface sampling device. This Work Assignment is written such that there are options in which this task can be accomplished. Test parameters shall be consulted with the EPA WAM prior to develop a QAPP.

A. Development of a Quality Assurance Project Plan (QAPP)
Project-specific details, including but not limited to number of tests, coupon materials, sampling strategies, analytical techniques, experimental controls, and coupon dosing method shall be outlined in a QAPP. The QAPP shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this IA (see Attachment #1) and the NHSRC QA requirement as defined in Attachment #1. No experimentation shall begin before this task is approved by the EPA Quality Assurance Officer (QAO) and by the CDC technical point of contact. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

B. Selection of liquid sampling agent: different types of sampling liquid shall be evaluated for detaching capability of spores from different surfaces and the best performing liquid type will be determined.

C. Optimization of wet vacuum process: this task shall determine the optimal temporal lapse between liquid application and suction as a function of surface type

D. Characterization of liquid agent amount as a function of surface type: the proper liquid volume per unit surface area shall be determined for best sampling results for various surfaces.

E. Development of a Bio All Surface Sampler: the 3 to 5 types of commercial products shall be evaluated for 3 to 5 different surface types. The selection criteria shall be provided by the EPA WAM. If there is no appropriate sampler identified, then a proto-type sampler shall be developed or modified in the laboratory.

F. Data Summary Report
Following completion of all data collection, a brief report shall be prepared documenting the details of the tests, including methods, quality control measures utilized, collected data, interpreted results, and conclusions.

7.0 Deliverables

The contractor shall submit deliverables in electronic and hard copy formats. (Some deliverables are information products and may need to be formatted, or entered, as required, in online tools.) Draft and final deliverables shall be in Microsoft Word, Microsoft Excel, Microsoft PowerPoint, Microsoft Project, and/or Adobe PDF Format.

QAPP Amendment

A draft QAPP and Work Plan shall be provided by the EPA within 45 days of the award of this agreement. This shall be provided prior to commencement of the tests described within this SOW. The combined QAPP and Work Plan shall include scope, scheduling, and costing information for each of the tests planned.

Reporting

A Draft Report shall be provided by EPA for review by March 15, 2014.

8.0 Period of Performance

The period of performance for this Work Assignment is from the date of award through March 31, 2014.

9.0 Responsibilities

The experimental work and reporting under this Work Assignment is a collaborated effort between the USEPA Office of Research and Development, National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) in Research Triangle Park, NC and Office of Emergency Management, Chemical, Biological, Radiological, and Nuclear Consequence Management Advisory Team. The U.S. EPA technical points of contact shall be Dr. Sang Don Lee (9199-541-4531, email lee.sangdon@epal.gov), Dr. M. Worth Calfee (phone 919-541-7600, email calfee.worth@epa.gov) and Dino Mattorano (phone 513-487-2424, email mattorano.dino@epa.gov.

NHSRC QUALITY ASSURANCE REQUIREMENTS FORM
Attachment 1 to the Statement of Work

I GENERAL INFORMATION

Title:	Development of a Vacuum-based Biological Agent Surface Sampling Device Performance
Description:	Currently, there are three surface sampling devices used for biological agents including swabs, wipes, and vacuums fitted with filter-type collection media. Operationally and logistically it is challenging to prepare and utilize these three different collection methods. Furthermore, total sample collection efficiency for each of the three methods range from 12 to 40%. The new sampling device will be operationally and logistically more efficient and total sample collection efficiencies are expected to be higher than existing devices. For the swabs, wipes and vacuums; laboratory processing includes removing the biological agent from the sampling media. During this processing there are agent losses due to inefficiencies. The developed device will not require post-collection processing, as agents are captured directly into a liquid that can be analyzed. As such, the developed method will likely have higher recovery efficiencies than the existing methods. The results of this work will be made available through published reports, journal papers, and/or conference abstracts and presentations.
Project ID:	B.1.2.1.02
Status:	Original
Number Ammended:	
QA Category:	III
Action Type:	Extramural
Peer Review Category:	IV
Security Classification:	Unclassified
Project Type:	Applied Research
QAPP Status 1:	Not Delivered
Vehicle Status:	Existing Vehicle
Vehicle Type:	Vehicle Number: EP-C-09-027 Work Assignment Number: 4-26 Delivery/Task Order Number: N/A Modification Number: 0 Other:

*If you are processing an **IAG** or **CRADA**, the responsibility for QA must be negotiated within the agreement. The TLPs in consultation with the QAMs in the various organizations must agree on, and document, which organization will take the lead for QA, the names of the QAM and TLP from each organization, and the QA requirements that will be adhered to during the agreement. Include this info in the IAG/CRADA package.*

II SCOPE OF WORK

Yes Does the Statement of Work contain the appropriate QA language?

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with the R-2 and R-5 and/or the attachments provided with the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf

Yes Does this extramural action involve the collection, generation, use, and/or reporting of environmental data; the

design, construction, and operation of environmental technologies; or development of software, models, or methods?

(If "No" then skip to Section IV, and sign the form.)

No — Will the SOW or any subsequent work assignments or task orders involve any cross-organizational efforts within EPA?

No — Has a QAPP already been approved for the activities specified in the SOW?

Yes — Is an applicable QAPP in the process of being prepared, revised, or approved by EPA personnel for future use by the contractor? (QA approval must be obtained before the contractor can start work.)

Provide the expected title for submission to QA staff for approval:

Development of a Vacuum-based Biological Agent Surface Sampling Device Performance

Provide the approximate date for submission to QA staff for approval:

10/31/2013

III QA DOCUMENTATION OPTIONS

All documentation specified under "Other" must be defined in the NHSRC Quality Management Plan and be consistent with requirements defined in EPA Manual 5360 A1. For all items checked below, there must be adequate information in the SOW (or its appendices) for the offeror to develop this documentation. Where applicable, reference a specific section of the SOW. *(R-2 refers to EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, 03/20/01) and R-5 refers to EPA Requirements for Quality Assurance Project Plans (QA/R-5) (EPA/240/B-01/003, 03/20/01). Copies of these documents are available at http://www.epa.gov/quality/qa_docs.html.)*

After Award Documentation

Not Applicable	Documentation of an organization's Quality System. QMP developed in accordance with:
Not Applicable	Combined documentation of an organization's Quality System and application of QA and QC to the single project covered by the contract: Developed in accordance with:
Other	Documentation of the application of QA and QC activities to applicable project(s). Developed in accordance with:
	Explain: The QAPPs shall be developed in accordance with the attachment #1 (QAPP requirements for applied research projects)
N/A	Programmatic QA Project Plan with supplements for each specific project, developed in accordance with:
Not Applicable	Existing documentation of the application of QA and QC activities will be used:

IV SIGNATURE BLOCK

The signatures below verify that the Statement of Work (SOW) has been reviewed to ascertain the necessary QA and QC activities required to comply with EPA Order 5360.1 A2, that the COR understands these requirements, and that the COR will ensure that the quality requirements indicated on the previous pages of this form are incorporated into all associated SOWs. *(Sign/date below, obtain a concurrence signature from the QA Staff, and submit the form along with the other extramural action documentation.)*

Sangdon Lee	09/17/2013	Ramona Sherman	09/17/2013

NHSRC-DCMD Technical Lead Person Date NHSRC-IO QA Staff Member Date

QAPP REQUIREMENTS FOR APPLIED RESEARCH PROJECTS
(from Appendix B of the NHSRC QMP)

An applied research project is a study to demonstrate the performance of technologies under defined conditions. These studies are often pilot- or field-scale. The following requirements should be addressed as applicable

SECTION 0.0, APPROVAL BY PROJECT PARTICIPANTS

The EPA Technical Lead Person (TLP) shall be responsible for obtaining signatures of appropriate project participants on the signature page of the QA plan, documenting agreement to project objectives and the approach for evaluating these objectives

A distribution list shall be provided to facilitate the distribution of the most recent current version of the QAPP to all the principal project participants.

SECTION 1.0, PROJECT DESCRIPTION AND OBJECTIVES

1.1 The purpose of study shall be clearly stated.

1.2 The process, site, facility, and/or environmental system to be tested shall be described.

1.3 Project objectives shall be clearly stated and identified as primary or non-primary.

SECTION 2.0, PROJECT ORGANIZATION

2.1 Key points of contact for each organization involved in the project shall be identified

2.2 All QA Managers and their relationship in the organizations(*i.e.*, location within each organization) shall be identified with evidence that the QA Manager is independent of project management.

2.3 Responsibilities of all other project participants and their relationship to other project participants shall be identified meaning that organizations responsible for planning, coordination, sample collection, sample custody, measurements (*i.e.*, analytical, physical, and process), data reduction, data validation, and report preparation shall be clearly identified

SECTION 3.0, EXPERIMENTAL APPROACH

3.1 The general approach and the test conditions for each experimental phase shall be provided. The statistical methods that will be used to evaluate the data (*i.e.*, ANOVA, or summary statistics) should be identified.

(NOTE: As deemed appropriate to the project by the TLP, the information requested in Sections 3.2, 3.3, and 3.4 may be presented here or in Section 4; the information requested in Sections 3.5 may be presented here or in Section 5; and the information requested in Sections 3.6 may be presented here or in Section 7.)

3.2 The sampling strategy shall be included and evidence must be presented to demonstrate that the strategy is appropriate for meeting primary project objectives, *i.e.*, a description of the statistical method or scientific rationale used to select sample sites and number of samples shall be provided.

3.3 Sampling/monitoring points for all measurements (*i.e.*, including locations and access points) shall be identified.

3.4 The frequency of sampling/monitoring events, as well as the numbers for each sample type and/or location shall be provided, including QC and reserve samples.

3.5 All measurements (*i.e.*, analytical [chemical, microbiological, assays], physical, and process) shall be identified for each sample type or process, and project-specific target analytes shall be listed and classified as critical or noncritical in the QAPP.

3.6 The planned approach (statistical and/or non-statistical) for evaluating project objectives shall be included

SECTION 4.0, SAMPLING PROCEDURES

4.1 Whenever applicable, the method used to establish steady-state conditions shall be described.

4.2 Known site_specific factors that may affect sampling/monitoring procedures shall be described.

4.3 Any site preparation needed prior to sampling/monitoring shall be described.

4.4 Each sampling/monitoring procedure to be used shall be discussed or referenced. If compositing or splitting samples, those

procedures shall be described.

4.5 For samples requiring a split sample for either QA/QC purposes or for shipment to a different laboratory, the QAPP shall identify who is responsible for splitting samples, and where the splitting is performed (*e.g.*, field versus lab).

4.6 If sampling/monitoring equipment is used to collect critical measurement data (*i.e.*, used to calculate the final concentration of a critical parameter), the QAPP shall describe how the sampling equipment is calibrated, the frequency at which it is calibrated, and the acceptance criteria for calibration or calibration verification as appropriate.

4.7 If sampling/monitoring equipment is used to collect critical measurement data, the QAPP shall describe how cross-contamination between samples is avoided.

4.8 The QAPP shall include a discussion of the procedures to be used to assure that representative samples are collected.

4.9 A list of sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis, shall be specified.

4.10 Containers used for sample collection, transport, and storage for each sample type shall be described.

4.11 Describe how samples are uniquely identified.

4.12 Sample preservation methods (*e.g.*, refrigeration, acidification, *etc.*), including specific reagents, equipment, and supplies required for sample preservation shall be described.

4.13 Holding time requirements shall be noted.

4.14 Procedures for packing and shipping samples shall be described.

4.15 Procedures to maintain chain of custody (*e.g.*, custody seals, records) during transfer from the field to the laboratory, in the laboratory, and among contractors and subcontractors shall be described to ensure that sample integrity is maintained.

4.16 Sample archival requirements for each relevant organization shall be provided.

SECTION 5.0, TESTING AND MEASUREMENT PROTOCOLS

5.1 Each measurement method to be used shall be described in detail or referenced. Modifications to EPA approved or similarly validated methods shall be specified.

5.2 For unproven methods, verification data applicable to expected matrices shall be included in the QAPP meaning the QAPP shall provide evidence that the proposed method is capable of achieving the desired performance.

5.3 For measurements which require a calibrated system, the QAPP shall include specific calibration procedures applicable to each project target analyte, and the procedures for verifying both initial and continuing calibrations(including frequency and acceptance criteria, and corrective actions to be performed if acceptance criteria are not met).

SECTION 6.0, QA/QC CHECKS

6.1 At a minimum, the QAPP shall include quantitative acceptance criteria for QA objectives associated with accuracy, precision, detection limits, and completeness for critical measurements (process, physical, and analytical, as applicable) for each matrix.

6.2 Any additional project-specific QA objectives shall be presented, including acceptance criteria. This includes items such as mass balance requirements.

6.3 The specific procedures used to assess all identified QA objectives shall be fully described.

6.4 The QAPP shall list and define all other QC checks and/or procedures (*e.g.*, blanks, surrogates, controls, *etc.*) used for the project, both field and laboratory.

6.5 For each specified QC check or procedure, required frequencies, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met shall be included.

SECTION 7.0, DATA REPORTING, DATA REDUCTION, AND DATA VALIDATION

7.1 The reporting requirements (*e.g.*, units, reporting method [wet or dry]) for each measurement and matrix shall be identified.

7.2 The deliverables expected from each organization responsible for field and laboratory activities shall be listed.

7.3 Data reduction procedures specific to the project, and also specific to each organization, shall be summarized.

7.4 Data validation procedures specific to each organization used to ensure the reporting of accurate project data to internal and external clients shall be summarized.

7.5 Data storage requirements for each organization shall be provided

7.6 The product document that will be prepared for the project shall be specified(*e.g.*, journal article, final report, *etc.*). The contents of this document can be referenced to a NHSRC or program-specific QMP, if appropriate.

SECTION 8.0, ASSESSMENTS

8.1 The QAPP shall identify all scheduled audits (*i.e.*, both technical system audits [TSAs] and performance evaluations [PEs]) to be performed, who will perform these audits, and who will receive the audit reports.

8.2 The QAPP shall provide procedures that are to be followed that will ensure that necessary corrective actions will be performed

8.3 The responsible party(-ies) for implementing corrective actions shall be identified

SECTION 9.0, REFERENCES

References shall be provided either in the body of the text as footnotes or in a separate section.

Attachment # 2

NHSRC QA
To the Statement of Work
Requirements/Definitions List

EPAs Quality System Website: http://www.epa.gov/quality
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html
EPA's Quality System Website: http://www.epa.gov/quality/qs-docs/r5-final.pdf

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) **a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;**
(2) **an organizational chart showing the position of the QA function;**
(3) **delineation of the authority and responsibilities of the QA function;**
(4) **the background and experience of the QA personnel who will be assigned to the project; and**
(5) ***the organization's general approach for accomplishing the QA specifications in the SOW.***

NHSRC QA Requirements/Definitions List
Category Level Designations (determines the level of QA required):

☐ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP: QAPP** requirements for the specific project type (see below).

☐ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP QAPP** requirements for the specific project type (see below).

Project Types:

These outlines of NHSRC's QAPP Requirements for various project types, from Appendix B of the NHSRC QMP (except where otherwise noted), are condensed from typically applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These lists and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

☐ **Applied Research Project** - pertains to a study performed to generate data to demonstrate the performance of accepted processes or technologies under defined conditions. These studies are often pilot- or field-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Applied Research Projects" from Appendix B of the NHSRC QMP.

☐ **Basic Research Project** - pertains to a study performed to generate data used to evaluate unproven theories, processes, or technologies. These studies are often bench-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Basic Research Projects" from Appendix B of the NHSRC QMP.

☐ **Design, Construction, and/or Operation of Environmental Technology Project** - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" G-11, at http://www.epa.gov/quality/QS-docs/g11-final-05.pdf. For additional information, you may refer to Part C of "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology," ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995.

☐ **Geospatial Data Quality Assurance Project** - pertains to data collection; data processing and analysis; and data validation of geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" G-5S at http://www.epa.gov/quality/QS-docs/g5s-final-05.pdf.

☐ **Method Development Project** - pertains to situations where there is no existing standard method, or a standard method needs to be significantly modified for a specific application. The QAPP shall address all requirements listed in "QAPP Requirements for Method Development Projects" from Appendix B of the NHSRC QMP.

☐ **Model Development Project** - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" G-5M at http://www.epa.gov/quality/QS-docs/g5m-final.pdf.

☐ **Sampling and Analysis Project** - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information. The QAPP shall address all requirements listed in "QAPP Requirements for Sampling and Analysis Projects" from Appendix B of the NHSRC QMP.

☐ **Secondary Data Project** - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. The QAPP shall address all requirements listed in "QAPP Requirements for Secondary Data Projects" from Appendix B of the NHSRC QMP.

☐ **Software Development and Data Management Project** - pertains to software development, software/hardware systems development, database design and maintenance, data validation and verification systems. The QAPP shall address all requirements listed in "QAPP Requirements for Software Development Projects" from Appendix B of the NHSRC QMP.

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs-r2-final.pdf.

R-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r5-final.pdf.

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Technical Lead Person (TLP) - This person is technically responsible for the project. For extramural contract work, the TLP is typically the contracting officer's representative (COR). For intramural work, the TLP is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
NRMRL	National Risk Management Research Laboratory	QAM	Quality Assurance Manager
QA ID	Quality Assurance Identification	QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan	SOW	Statement of Work
QS	Quality System	CRADA	Cooperative Research & Development Agreement
TLP	Technical Lead Person		

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-27

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	APPCD Metrology QA Laboratory

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Scott Moore (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-5104 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 3-27-13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

SOW FY 2013-2014
Period of Performance: 04/01/2013 – 03/31/2014
Work Assignment Manager (WAM): Scott A. Moore
Work Assignment Title: APPCD Metrology QA Laboratory Support
Contract Number: EP-C-09-027
Work Assignment Number: 4-27

Introduction

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To ensure good QA it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to ensure that it produces reliable data. The Air Pollution Prevention and Control Division (APPCD) require that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (MetLab) provides QA assistance to APPCD researchers by providing the procedures and the standards to calibrate various scientific devices.

I. Goal/Purpose

The objective of this Work Assignment (WA) is to provide MetLab support to APPCD. The MetLab is a facility with the capabilities to check (or audit) the calibration of Environmental Protection Agency (EPA) measurement instrumentation. A second objective is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to ensure and document that operations performed in EPA facilities produce data that will be of a known and adequate quality. This work assignment does not pertain to the calibration of facility devices such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons.

II. Background Information

Data Uses — Primary users of the products of this WA will be researchers and operators of equipment in EPA/APPCD facilities. Calibration and PEA results can be reported in research reports to support or verify findings.

Lab Site — The MetLab is located in rooms D360-A, D362, and D364-A in EPA's Research Center in Research Triangle Park, NC.

Experience — Personnel assigned to this WA must be capable of performing the tasks listed in Section III (Tasks), which include electrical work, plumbing, general experience with lab equipment and materials, a familiarity with the calibration of measurement devices, and a fundamental understanding of the principals behind the measurements and the ability to reduce data and report it according to the International Organization for Standardization ISO 17025 "General Requirements for the Competence of Calibration

and Testing Laboratories" (ISO 17025) standard and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

III. Tasks: APPCD Metrology QA Laboratory Support

Task I. Lab Equipment and Supplies

(1) The Contractor shall obtain performance specifications on potential calibration equipment. The Contractor shall maintain and upgrade calibration systems and equipment as needed. Final decisions regarding upgrading and replacing equipment will be relayed to the Contractor in a technical directive through the WAM.

(2) The Contractor shall maintain MetLab equipment in proper working order. The Contractor shall identify calibration needs and ensure that the necessary factory equipment calibrations for the MetLab equipment are kept up to date. The Contractor shall maintain a record of all maintenance activities. Whenever practically possible the calibration data for this equipment shall include National Institute of Standards and Technology (NIST) traceable information.

Task II. MetLab Operations

(1) The Contractor shall implement a "Work Request Form" to conform to ISO 17025 and the GUM requirements. The Contractor shall insure that the information is correct for the Division, Branch, Office location, Name and Phone number for each requestor. And will retain a copy of each request via hard copy or digital copy.

(2) The Contractor shall perform measurement device and equipment calibrations that conform to ISO 17025 and the GUM. The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WAM shall be notified and then provide technical direction to the contractor for prioritization. The Contractor shall maintain a record and data base of all equipment calibrations and calibration schedules.

(3) The Contractor shall develop, document, and implement detailed calibration operating procedures for all laboratory calibration services.

(4) The Contractor shall assemble and maintain a system of published procedures and product information relevant to calibration measurement procedures and measurement devices.

Task III. Validation of Procedures and Calibration Tracking System

The Contractor shall confirm the current acceptable validation methods for all calibration systems used in the MetLab and also for the calibration tracking system. Any confirmation of validation methods should be documented. All database functions that are user-programmed shall be tested and the validation documented. Each revision to the database software (exclusive of the data in the database) shall have an identifiable revision number assigned to it.

Task IV. Recertification of APPCD Analytical Balances

The contractor shall recertify all analytical balances that are in active use and that have not been recertified within the past year. These balances have been identified in a spreadsheet that has been prepared by APPCD's QA team and that has been given to the contractor. The contractor shall contact the individual who has been identified as each balance's custodian to arrange for a data to recertify the balance. After each balance recertification, the contractor shall update the spreadsheet, which it shall maintain in a location easily accessible to all APPCD staff.

Task V. Monitoring of Temperatures of APPCD Refrigerators and Freezers

APPCD has purchased HOBO temperature data loggers to monitor the temperatures of APPCD refrigerators and freezers. The contractor shall verify the calibration of the data loggers on a yearly basis. After the verification, the contractor shall deploy the data loggers in APPCD refrigerators and freezers. Thrice-yearly the contractor shall download temperature data from the data loggers, replace batteries if necessary, and post the downloaded data in a location easily accessible to all APPCD staff.

Task VI. ETV Program QA/QC Support

The Contractor shall provide QA/QC Support to APPCD's ETV projects. This support shall include performing routine and non-routine equipment calibrations/calibration checks, the development, verification and documentation of calibration methods, obtaining and/or preparing performance evaluation samples, as well as other specialized QA/QC support identified in technical directives by the WAM.

Task VII. ISO 17025 Accreditation

The Contractor shall continue to apply the ISO 17025 standards in the operation of the Met Lab. Three factors prevent the Met Lab from acquiring the accreditation: 1) The price of accreditation, 2) The time needed to perform the accreditation and 3) The is no need for the accreditation as all calibration are internal to the EPA.

IV. Deliverables (Applies to all Tasks and Sub-Tasks)

The Contractor shall provide the following reports for APPCD:

(1) Monthly reports of the laboratory support activities including the following:

a) The number of and type of calibrations performed.
b) Any costs incurred during calibration activities.
c) Any maintenance activities performed.
d) Any documentation activities performed.
e) Status of the Facility Manuals.
f) Any other activities that would impact the operation of the MetLab.

(2) Special reports as requested via a Technical Directive by the WAM.

(3) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WAM shall be notified and then provide technical direction to the contractor for prioritization.

(4) The WAM shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WAM.

(5) The contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(6) Formatting of reports shall be consistent with historical reporting and electronic files shall be compatible with Agency Standard Software, such as MS Excel 2007, MS Word 2007 and Adobe Reader 9.0 or current agency standard software. Hard copies of reports are acceptable; however, electronic copies are encouraged.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-30

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014	
	Base X Option Period Number	

Contractor	Specify Section and paragraph of Contract SOW
ARCADIS U.S., INC.	

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period:	Cost/Fee:	LOE:
04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name Thomas Long	(Signature)	(Date)	Branch/Mail Code: / Phone Number 919-541-3944 / FAX Number:
Project Officer Name Kevin Sudderth	(Signature)	(Date)	Branch/Mail Code: / Phone Number: 919-541-3670 / FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: / Phone Number: / FAX Number:
Contracting Official Name William Yates	William Yates (Signature)	3-28-13 (Date)	Branch/Mail Code: / Phone Number: 513-487-2055 / FAX Number:

Performance Work Statement
Contract EP-C-09-027
Work Assignment 4-30

Title

Biodiesel Speciated Fuel and Temperature Effects in Heavy-Duty Diesel Engines

Description

Generate cold temperature emissions data from Light (8,500 Gross Vehicle Weight Rating (GVWR) < LHDDT<19,500 GVWR) and Medium (19,500 GVWR<MHDDT< 33,000 GVWR) Heavy Duty Diesel Trucks (per the Emission Standards Reference Guide for Heavy-Duty and Nonroad Engines). At least one vehicle will be tested on both the heavy-duty chassis dynamometer and the light-duty chassis dynamometer. Driving cycles will consist of up to five heavy- or medium-heavy-duty cycles including the Heavy-Duty Urban Dynamometer Driving Schedule (http://www.epa.gov/otaq/emisslab/methods/huddscol.txt).

Background

This project directly addresses the air, climate, and human health program areas, and supports the other motor vehicle as well as the biodiesel biofuels initiative projects. The 2007 Diesel Highway Rule (40 CFR Parts 69, 80, and 86), phased in new emissions standards requiring 100% compliance in 2010. While the two currently regulated "critical pollutants", particulate matter (0.01 grams per brake-horsepower-hour (g/bhp-hr)) and NO_x (0.20 g/bhp-hr) impact air quality and related health issues, proposed new rules focus on two related areas with broader environmental and social effects: truck fuel economy and greenhouse gas (GHG) emissions. The two go hand-in-hand because burning carbon-based petroleum fuels creates carbon emissions, so improving fuel economy directly lowers an internal combustion engine's main GHG, carbon dioxide (CO_2).

Scheduled to be phased in between 2014 and 2018, new truck rules are part of an overall energy strategy that looks to reduce U.S. dependency on foreign energy supplies and lower CO_2 creation to address global warming concerns. It is estimated that commercial trucks consume more than 2-million barrels of oil every day and account for 20% of transportation-related GHGs. For example, the state of California estimates that diesel trucks are responsible for seven and a half percent of all of California's global warming pollution.

The call for truck rules does not come with specific target numbers, but requires EPA, with the aid of the National Highway Transportation Safety Administration (NHTSA) to set standards based on research data. Much of the guidance for determining the standards will come from a congressionally mandated report. Created under the auspices of the National Research Council (NRC), "Technologies and Approaches Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles" was put together by a 19-member panel that combined academic researchers,

engineers, and technologists with backgrounds in truck and component manufacturing.

Diesel Particulate Matter (PM) consists of three primary constituents: elemental carbon particles from incomplete combustion, which make up the largest portion of the total PM; the soluble organic fraction (SOF), which consists of unburned hydrocarbons that have condensed into liquid droplets or have adsorbed onto the surfaces of the elemental carbon particles; and sulfates with associated water, which result from oxidation of fuel-borne sulfur in the engine's exhaust.

Several exhaust emission control devices have been developed to control diesel PM constituents – the diesel oxidation catalyst (DOC), and the many forms of PM filters, catalyzed diesel particulate filters (CDPFs), or PM traps. DOCs have been shown to be durable in use, but they effectively control only the soluble organic fraction (SOF) portion of the total PM which, especially on today's engines, constitutes only around 10 to 30 percent of the total PM. Therefore, the DOC alone is not capable of meeting the FTP 0.01 g/bhp-hr PM standard set in the 2007 Diesel Highway Rule.

This study will focus on the effects to emissions from the use of biodiesel blend (B20 – ASTM D7467) fuel in on-road vehicles. The use of biodiesel in fuel has increased nearly three-fold since 2005, according to the National Biodiesel Board. The use of biodiesel increases the minimum usable (cloud point, pour point, and cold filter plugging point) temperature by as much as 10 degrees Fahrenheit without the use of additives. Cold temperature testing will take place at 20 degrees Fahrenheit.

For these reasons, this study will focus on the use of B20 in vehicles fitted with diesel particulate traps to mitigate the emission of elemental carbon particles. The baseline fuel will be ultra-low-sulfur diesel fuel (ULSD) conforming to 40 *Code of Federal Regulations* 86.1313-2007.

The US EPA Heavy-Duty Highway Rule applies to vehicles manufactured in 2007 and beyond. It also limits fuel to less than 15 ppm of sulfur. While heavy-duty vehicles only make up $1/10^{th}$ the VOC emissions of light-duty vehicles and roughly 6% of the CO emissions, they contribute nearly the same amount of NO_x, and 1.5 times the $PM_{2.5}$. Hydrocarbon (HC) emissions are composed of hundreds of compounds, some of which have been identified by the EPA as air toxics. The Clean Air Act directs EPA to set standards to reduce air toxics emissions. For this reason, both regulated emissions and a subset of speciated emissions will be measured and reported.

For heavy-duty diesel engines of model year 2010 and later, certification testing is to be performed in conformance with 40 CFR 1065. This study will use vehicles of MY 2010 or later and therefore testing will conform to 40 CFR 1065 (exceptions to be noted in the Quality Assurance Project Plan).

Scope and Objectives

This Work Assignment (WA) has been designed to fill significant data gaps on temperature and fuel effects for biodiesel blend fuels in vehicles fitted with particulate traps:

- Test cycles will include a cold start Lower Speed Transient Mode (MHDTLO) and warm start MHDTL from the CARB MHDT three-mode test, followed by the Federal Urban Dynamometer Driving Schedule (UDDS).
- Testing will be conducted at 20°F (-6.7°C) and 75°F (23.9°C) on two vehicles under both laden (100% GVWR) and unladen (50% GVWR) conditions.
- Core measurements will include Total hydrocarbon (THC), non-methane hydrocarbons (NMHC), non-methane organic gas (NMOG), oxides of nitrogen (NOx), nitrogen dioxide (NO2), carbon monoxide (CO), carbon dioxide (CO2) and particulate matter (PM)
- This program shall also generate speciated volatile organic compound (speciated VOC) data. VOC compounds of interest include C1 – C12 hydrocarbons as well as light alcohols and carbonyls.

The Contractor shall perform vehicle preparation and operate the analytical bench to generate analytical data on exhaust gas emissions. The Contractor shall also generate quality assurance documentation.

Work Requirements

The Contractor will supply two (2) vehicles for cold testing in triplicate. At least one vehicle will be an MHDDT. The remaining vehicle may be a LHDDT. Only one vehicle will be permitted to have a laden inertial weight in excess of the capacity of the light-duty dynamometer. The Contractor will also supply two representative blend fuels. One of these fuels will be B20. The other will be ULSD. The Contractor will supply all other testing supplies required unless EPA approves exceptions.

The Contractor shall be responsible for providing technical, and Quality Control (QC) support for this project. Technical support includes installing and maintaining all instrumentation and support equipment, as well as calibration, testing, and regulated emissions data processing activities. QC support will include completing the QC forms provided, in accordance with the Quality Assurance Project Plan (QAPP), to the bench operator for each day of testing.

Task 1 Work Plan Development

The Contractor shall submit a detailed work plan to the EPA for approval. The work plan shall include a detailed description of how the tasks described below are to be performed, including details. The work plan shall include suggested alternatives for any of the required tests or procedures if such alternatives are thought to result in higher quality results.

The project work plan shall include descriptions of each task to be accomplished, along with detail on the level of effort, by professional grade, a cost breakdown for each task, and any information on the underlying assumptions used in arriving at these cost estimates. The Contractor shall conduct necessary activities to properly and efficiently manage the work assignment, including at least weekly communication with the EPA WAM.

Task 2 Conformance with Quality-Assurance Project Plan and Quality Management Plan (QAPP/QMP)

The Contractor shall perform project specific duties in accordance with the Quality Assurance Project Plan (QAPP) provided by the EPA. The plan shall detail sample data collection and analysis tasks and procedures for the proposed study. The QAPP shall describe measures designed to ensure data quality, including but not limited to:

- Standard operating procedures for equipment used to perform calibrations.
- Calibration frequency and schedule for all equipment used in testing (analyzers, dynamometer, chemical speciation equipment).
- Procedures for data transfer, entry and management.
- Procedures for regular transfer of all data generated in this project to the EPA Work Assignment Manager for review/audit, consistent with Task 6.4 of this Statement of Work.

Task 3 Test Fuels and Lubricants

The Contractor will supply two representative fuels. One of these fuels will be biodiesel blend B20 – ASTM D7467. The biodiesel component of the B20 will be soy-based. The other will be a blend of ULSD (conforming with the Highway Diesel Rule, referred to as the "2007 Highway Rule"). Ideally, the base diesel fuel for the B20 will be as similar to the ULSD as practical while maintaining drivability at 20°F (-6.7°C).

The test fuels must be submitted for speciation after the completion of vehicle testing. The lubricants must be submitted for speciation prior to the inception of vehicle testing. The Contractor shall submit a proposed standard for both the fuel and oil analyses for approval by the Work Assignment Manager (WAM).

Task 4 Vehicle Procurement and Preparation

The Contractor shall procure two vehicles for testing. Each vehicle must be from either the Light (8,500 GVWR < LHDDT<19,500 GVWR) or Medium (19,500 GVWR<MHDDT< 33,000 GVWR) Heavy Duty Diesel Truck categories. A Dodge Ram 2500 with the 6.7L Cummins Turbo Diesel is an example of LHDDT, but the GVWR must be at or below 12,500 pounds (so that the laden case can be tested on the light-duty dynamometer). An example of a MHDDT is a diesel Ford F550 with a GVWR greater than or equal to 19,500. At least one of the two vehicles will be a Medium Heavy Duty Diesel Truck (MHDDT). The GVWR of all vehicles must be such that they can be tested unladen on the light-duty dynamometer. At least one of the two vehicles must be light enough to test laden on the light-duty dynamometer. All of the vehicles must be MY2010 or newer and equipped with a diesel particulate filter (DPF).

The two vehicles to be tested shall undergo a thorough inspection before beginning the test preparation sequence. This includes inspection and documentation of the engine, transmission, axles, exhaust system and tires, and documentation of the Engine Control Module (ECM) status. Photographs of the vehicles' exhaust systems, engine plates, and emission plates shall be taken and included as part of the progress and final reports. The Contractor shall collect and record vehicle information as described in the Quality Assurance Project Plan (QAPP).

Oil and air filters shall be procured by the Contractor according to manufacturer's recommendations. Engine oil recommended in the owner's manual of each vehicle shall be used. The recommended grade of lubricant shall be purchased.

After the last test of each vehicle in the program, the Contractor shall record the lubricant level indicated on the dipstick before collecting a 0.25-quart oil sample for analysis.

If any of the vehicles are equipped with traction control, the Contractor shall ensure that the traction control is disabled either through an interior disable button or other method (remove power fuse to anti-lock brake system (ABS), and place a placard in the vehicle indicating the method of disabling traction control if driver input is required.. The Contractor will be provided target road load coefficients and set road load coefficients for the test vehicles according to 40 CFR 1066.301 and 40 CFR 1066.310 (or the Contractor may propose and use an alternate

method, subject to approval by EPA). For the purpose of this study, the agreed road load setting shall remain the same for all testing on a given vehicle.

Task 5 Vehicle Testing

5.1 Basic Testing Protocol

The basic testing protocol begins with a cold start Lower Speed Transient Mode (MHDTLO), the Federal Urban Dynamometer Driving Schedule (UDDS), and ending with a warm start MHDTLO (from the three mode CARB MHDT. This protocol will be conducted in compliance with CFR Part 86 Subpart N and CFR Part 1065. This test sequence will be repeated for each fuel at 20°F (-6.7°C) and 75°F (23.9°C). This test sequence will be performed in both the laden (curb weight plus 90% of the payload) and unladen (curb weight plus 150 pounds) conditions at both temperatures. Each test condition will be run on each vehicle at least three times. A fourth test may be run if necessary as described in 5.1.1. All unladen tests on a given vehicle must be done using the 48-inch single roll electric light-duty chassis dynamometer. The laden tests may be performed on the 72-inch single roll electric heavy-duty chassis dynamometer if the load is in excess of the smaller dynamometer's capacity. The EPA will provide the same driver to be used for all tests on a given vehicle.

The portion of the matrix in Table 5.1-1 that is not completed by the end of March under WA 3-30 is to be completed under this work assignment. According to the schedule, the remaining test conditions will include conditions 15 and 16.

In addition to the remaining matrix conditions, it is anticipated that two to five weeks will be required to repeat some of the post-regeneration cold starts that did not occur during the execution of the original test conditions. These conditions that did not occur because the the diesel particulate filter (DPF) regeneration happened on a fourth day of testing. So far they include the following four conditions only for the LHDDT: the 75°F, ULSD fuel with laden loading; the 75°F, B20 fuel, unladen; the 20°F, B20 fuel, unladen; and the 20°F, B20 fuel, laden conditions.

Table 5.1-1 Core Test Matrix

Condition (3 Replicates)	Vehicle	FUELS		CELL TEMP		LOAD CASE		DYNO		TEST CYCLES		
		B20	ULSD	20F	75F	Unladen (50% GVWR)	Laden (90% GVWR)	LD Dyno	HD Dyno *no spec	Cold Start MHDT Lower Trans	MHDT Lower Trans	UDDS
1	LHDDT		X		X	X		X		x	x	x
2	LHDDT		X		X		X	X		x	x	x
3	LHDDT		X	X		X		X		x	x	x
4	LHDDT		X	X			X	X		x	x	x
5	LHDDT		X		X		X		X	x	x	x
6	LHDDT	X			X	X		X		x	x	x
7	LHDDT	X			X		X	X		x	x	x
8	LHDDT	X		X		X		X		x	x	x
9	LHDDT	X		X			X	X		x	x	x
10	LHDDT	X			X		X		X	x	x	x
11	MHDDT		X		X	X		X		x	x	x
12	MHDDT		X	X		X		X		x	x	x
13	MHDDT		X		X		X		X	x	x	x
14	MHDDT	X			X	X		X		x	x	x
15	MHDDT	X		X		X		X		x	x	x
16	MHDDT	X			X		X		X	x	x	x

LHDDT tested laden and unladen - Diesel -Both temps on LD Dyno then move to HD Dyno test diesel at 75F-Laden only

LHDDT tested laden and unladen - B20 -Both temps on LD Dyno then move to HD Dyno test B20 at 75F-Laden only

MHDDT tested unladen - ULSD -Both temps on LD Dyno then move to HD Dyno test at 75F-Laden only

MHDDT tested unladen - B20 -Both temps on LD Dyno then move to HD Dyno test at 75F-Laden only

NOTES
*Light Heavy Duty Diesel(8,500<LHDDT<19,500)
*Medium Heavy Duty Diesel Truck (19,500<MHDDT<33,000)
*A vehicle in excess of 24,000 GVWR could not be tested on the light-duty dynamometer even in the unladen state

All cycles on the light-duty dyno (36X) will be speciated
All cycles on the heavy-duty dyno (12X) will not be speciated
Speciation will include carbonyls, VOCs, PUFs, quartz filters, FTIR
EEPS on all tests (FTIR TBD)
Aethalometer on all tests
Teflon (gravimetric) filters on all tests
Test 1 - 4 Phase MHDT
Test 2 - 2 Phase Blank and UDDS (for HDV)

For low temperature tests, the vehicles will be preconditioned per 40 CFR 86.232-94 prior to testing. This protocol calls for a minimum 12 hour soak with a 20°F (-6.7°C) ±5°F (2.8°C) hourly average for the 20°F (-6.7°C) tests. The test cell temperature may not exceed 25°F or fall below 15°F for more than 3 consecutive minutes during the test (40 CFR 86.230-11 (c)(2)). Humidity shall be maintained 75±5 grains H_2O/lb dry air.

When using the light-duty dynamometer, the gaseous emissions to be measured and reported are THC, CH4, NO_x, NO_2, CO, and CO_2. The Contractor will use cleaned SUMMA cans to collect sample from which the US EPA will speciate the VOCs. The Contractor shall speciate the oxygenates. The Contractor will provide polyurethane foam (PUF) sorbent plugs and collect samples on which the US EPA will conduct PAH analyses. The Contractor will provide teflon filters for the EPA to perform metals analysis on the runs made on the light-duty dynamometer. The Contractor will provide DNPH cartridges and collect samples on which the US EPA will conduct carbonyl analyses. The Contractor will provide teflon filters on which the the US EPA will collect samples and perform gravimetric analyses.

During all emission tests, the Contractor shall record the following ECM parameters at the rate of 1 Hz using Contractor-supplied data acquisition equipment:

- RPM
- Vehicle speed
- Engine load
- Engine coolant temperature
- Manifold absolute pressure
- Air Flow Rate From Mass Air Flow Sensor

Additional, Parameter IDs that should be recorded when available (they vary by manufacturer) include:

- Intake Air Temperature
- Exhaust Gas Temperature Sensors
- NO_x accumulation
- Turbo KRPM
- Soot Load
- EGR Cooler By-pass Valve Position
- Ammonia Level on Selective Catalytic Reductant (SCR)
- SCR Operation Mode
- Reductant Injector Duty Cycle
- NO_x Sensor Concentration
- Oxygen Concentration
- Diesel Particulate Filter Percentage Load – Inferred
- Diesel Particulate Filter Regeneration Status
- Diesel Particulate Filter Regeneration Type
- Exhaust Pressure Sensor
- Engine Oil Temperature

The facilities for testing shall be configured to meet the requirements of 40 CFR Part 86 Subpart N or 40 CFR Part 1066 as they apply to vehicle emissions testing. THC, CH4, NO_x, NO_2, CO, and CO_2 emissions sampling and measurement shall be conducted as specified in 40 CFR 1065. The minimum detection limit for NO_2, measurements shall be 5 ppb. If some aspect of testing will need to be done in variance to the above specifications the Contractor shall describe why that is the case and how it may impact the test results. Variances must be approved by the EPA WAM before testing may begin.

The Contractor shall verify that the tunnel flow remained constant during the test. The CVS blower shall be kept on for ½ hour before the first emission test on a given day and continuously between emission tests to ensure tunnel stability.

The Contractor shall provide defined and maintained cooling fan placement and flow for each test vehicle on all the tests. The flow of air sweeping the vehicle in the test cell shall be consistent between tests.

The Contractor shall perform "blank" UDDS tests at one month intervals during this program. These tests will involve running the full test sequence drawing only background air into the sampling system. All sampling systems will be operated and measurements will include:

- Phase level THC, CH_4, CO, NO_x, CO_2, PM, NO_2, VOCs (including alcohols and carbonyls)
- Continuous THC, CH_4, CO, CO2 and NO_x

5.1.1 Fuel Change and Test Execution Sequence

The Contractor shall follow the fuel change and test execution sequence described in Table 5.1-2, below making sure that during all refueling events the vehicle shall be parked in the same location, facing the same direction. A picture will be taken to document compliance. This picture will be submitted to the EPA with other QA documents.

The first three emission tests on a given vehicle and fuel combination shall be performed back-to-back. After three tests have been completed and the acquired data has passed all quality control verifications as described in the QAPP, the need for a fourth test shall be determined by following the variability criteria shown in Table 5.1-3. Specifically, if the percent standard error of the mean (SEM) for the CO_2, NO_X or THC results from three tests on a given vehicle and fuel combination exceeds the levels shown in Table 5.1-3, the Contractor shall proceed with a fourth test and notify the EPA WAM within 24 hours, making available the electronic summary reports of the tests in question. The fourth replicate shall be run the same way as the third. The third and the fourth replicates shall also be done back-to-back.

Table 5.1-2. Fuel Change and Test Execution Sequence

Step	Description
1	Drain vehicle fuel completely via fuel rail whenever possible.
2	Turn vehicle ignition to RUN position for 30 seconds to allow controls to allow fuel level reading to stabilize. Confirm the return of fuel gauge reading to zero.
3	Turn ignition off. Fill fuel tank to 40% with next test fuel in sequence. Fill-up fuel temperature must be less than 50°F.
4	Start vehicle and execute catalyst sulfur removal procedure described in Appendix C of CRC E-60 Program report. Apply side fan cooling to the fuel tank to alleviate the heating effect of the exhaust system. Engine oil temperature in the sump will be measured and recorded during the sulfur removal cycle.
5	Perform four vehicle coastdowns from 70 to 30 mph, with the last two measured. If the difference between the last two coastdown times exceeds 0.5 sec. or their average differs by more than ±7% from the running average for that vehicle, then the vehicle will be checked for any obvious and gross source of change in its mechanical friction.
6	Drain fuel and refill to 40% with test fuel. Fill-up fuel must be less than 50°F.
7*	Drain fuel again and refill to 40% with test fuel. Fill-up fuel must be less than 50°F.
8	Soak vehicle for at least 12 hours to allow fuel temperature to stabilize to the test temperature.
9	Start vehicle and perform three Lower Speed Transient Mode (MHDTLO) cycles. During these prep cycles, apply side fan cooling to the fuel tank to alleviate the heating effect of the exhaust system. Following the first two prep cycles, allow vehicle to idle in park for two minutes, then shut-down the engine for 2-5 minutes. Following the last prep cycle, allow the vehicle to idle for two minutes, then shut down the engine in preparation for the soak.
10	(Reserved)
11	Park vehicle in soak area at proper temperature (20°F (-6.7°C) or 75°F (23.9°C)) for 12-36 hours. During the soak period, maintain the nominal charge of the vehicle's battery using an appropriate charging device.
12	(Reserved)
13	Perform a Lower Speed Transient Mode (MHDTLO), soak 10 minutes, perform the three mode MHDT test, and perform the UDDS emissions test.
14	(Reserved)
15	Park vehicle in soak area of proper temperature for 12-36 hours. During the soak period, maintain the nominal charge of the vehicle's battery using an appropriate charging device.
16	(Reserved)
17	Perform a Lower Speed Transient Mode (MHDTLO), soak 10 minutes, perform the three mode MHDT test, and perform the UDDS emissions test.1.
18	Determine whether third replicate is necessary, based on data variability criteria (see Table 5.1-3).
19	If a third replicate is required, repeat steps 14, 15, 16 and 17. If the third replicate is not required, return to step 1 and proceed with next vehicle in test sequence.

* Step 7 shall be executed for vehicles selected by the EPA WAM following the refueling experiment described in Task 4 Vehicle Preparation.

Table 5.1-3. Variability Criteria for Triplicate Testing

Dilute Gaseous Emission	Criteria for requiring a third test (composite cycle emissions)
CO_2	SEM > 3%
NOx	SEM>10%
THC	SEM>10%

The criteria provided in Table 5.1-3 as well as cranking time criterion are expected to result in a 5% test replication rate.

5.2 Speciation of Volatile Organic Compounds (VOCs)

VOC speciation shall include C1-C12 hydrocarbons as well as light alcohols, and carbonyls. Sampling and analysis of C2-C12 hydrocarbons shall be done using TO-15. VOC sampling will be performed by the Contractor. VOC analysis will be conducted by the EPA. Sampling and analysis of alcohols shall be done using CARB method 1001, "Determination of Alcohols in Automotive Source Samples by Gas Chromatography" as modified by the MOP included in the QAPP. Sampling and analysis will be the responsibility of the Contractor.

Sampling and analysis of carbonyl compounds shall be done using TO-11a. Carbonyl sampling is to be performed by the Contractor. Carbonyl analysis will be performed by the EPA.

During the analysis of C2-C4 hydrocarbons, special consideration shall be given to 1,3-butadiene. Because of the instability of 1,3-butadiene the analysis of C2 – C4 hydrocarbon samples collected during phase 1 of the test cycle shall be initiated within one hour of collection. The speciation of C5-C12 hydrocarbon samples collected in phase 1 of the test cycle shall be completed within 4 hours of collection. The time between sample collection and the start of C2-C4 and C5-C12 hydrocarbon analysis shall be reported. VOC sampling is to be performed by the Contractor. VOC analysis will be performed by the EPA. The Contractor shall work with the chemist to make every effort to complete the analysis of C2-C4 and C5-C12 background hydrocarbon samples on the day they are collected.

The Contractor shall seal and store alcohol samples at a temperature below 40°F immediately following collection. The Contractor shall make every effort to analyze these samples on the day they are collected, but no later than within six calendar days.

Samples of carbonyl compounds shall be collected in cartridge type samplers. The Contractor shall extract these samples immediately following collection (within 15 minutes) and the extracts sealed and stored immediately at a temperature below 40°F. The Contractor shall provide segregated storage for alcohol and carbonyl samples to prevent their contamination.

No more than one vehicle shall be tested per test day, unless the Contractor can demonstrate that the total number of vehicles tested on that day and the timing of their tests will not compromise the time limit requirements imposed on sample analyses.

5.3 (Reserved)

5.4 PM measurement and Analysis

PM shall be collected on a Teflon filter and quartz filter for mass determination and subsequent chemical analysis. The sampling method shall allow for the collection of sufficient sample for chemical analyses. PM mass will be measured as specified in 40 CFR Part 1065. Deviations from this method will require approval from EPA.

Task 6 Coordination and Support of Non-regulated Emissions Measurements

6.1 Laser Instrument

No further support is required for laser instrument sampling.

6.2 FTIR

No further support is required for FTIR sampling.

6.3 PAH

Coordinate with Michael Hays to provide sufficient media to sample PAH's for 3 of the five sample phases per test.

6.4 VOC

Coordinate with Tom Long or designee to use sufficient clean and prepared SUMMA cans for VOC analysis for all five sample phases per test.

6.5 Metals

No further support is required for metals sampling.

Task 7 Deliverables

7.1 Work Plan

The Contractor shall submit a work plan for this Work Assignment.

7.2 (Reserved)

7.3 Weekly Reports

The Contractor shall provide a weekly contract progress report. This requirement can be met during weekly meetings or telephone conferences.

The oral report shall indicate progress achieved in the preceding week, technical issues encountered, solutions to issues (proposed or attempted), and projected activity in the following week. This report shall include any potential issues or circumstances that arise causing any delays in the testing. The EPA WAM or his/her designated alternate shall participate in these phone conferences.

The Contractor shall provide on a weekly basis to the EPA WAM a report summarizing hours and dollars

expended on the Tasks in the PWS and the number of valid tests performed with the raw data. The goal of the report is to identify as early as possible if costs in dollars, and hours are exceeding that which has been budgeted for the program by EPA and scheduled by the Contractor. The Contractor shall alert the EPA WAM if, anytime during this program, the cost per test exceeds the agreed upon amount. In case of such an exceedance, WAM approval will be required to continue the program.

7.4 Monthly Reports

The Contractor shall provide monthly progress reports and invoices in accordance with contract. See the Reports of Work, EPAAR clause 1552.211-70, Submission of Invoices, EPAAR clause 1552.232-70.

Schedule of Deliverables

Steps	Completion Date
Project work plan submission	Within 20 calendar days of receipt of WA
Emissions Testing Start	April 1, 2013
Emissions Testing Complete	May 17, 2013

8 Mobile Source Dynamometer Research Laboratory Infrastructure Support (to be priced separately)

In fulfillment of the objective of this task, the following Subtasks shall be performed by the Contractor, and throughout the course of performing these Subtasks, the Contractor shall comply with the most recent MSDRL Quality Assurance Project Plan (QAPP) entitled 'Dynamometer Research' and the SOP for the dynamometer to be used that week. Total cost of LOE and ODC to complete Task 8 shall not exceed $27,000.

8.1.1 The Contractor shall prepare and operate the dynamometer, analytical bench and CVS sampling system in accordance with the CFR and laboratory protocols established by the EPA. Variances are permitted only by technical direction and/or approval of the WAM.

8.1.2 The Contractor will perform instrument/equipment evaluations and repairs as necessary to demonstrate and maintain proper operability and will assist in facility/equipment problem resolution

8.1.3 The Contractor shall acquire supplies, consumables, and calibration/reference materials needed to assess regulated emissions, PM2.5, carbonyls, VOCs, SVOCs, MSATs, and oxygenates. Gas standards will be procured from Scott Specialty Gases or a vendor whose compliance with EPA standards has been shown to be statistically equivalent.

8.1.4 The Contractor shall forward the raw data to the WAM on the day the samples are taken.

8.1.5 Quality assurance forms provided by the WAM to the Contractor will be completed in accordance with WAM technical direction. An electronic copy (PDF) will be provided to the WAM on the day of completion.

8.1.6 Protocols will be provided to the Contractor by the EPA Work Assignment Manager prior to initiation of the technical work.

8.1.7 The Contractor shall maintain a sample custody log of PM, DNPH, water impingers, passivated canisters, fuels, and bags submitted for sampling and/or received for analysis following sample collection. In the majority of cases, it may be necessary for a number of individual samples from a single source to be composited, thereby necessitating careful recording of the composited samples. The WAM will also notify the Contractor of the analytical method they plan to apply

prior to analyzing any sample set.

8.1.8 The Contractor shall provide for appropriate handling and disposal of all laboratory waste materials, including expired test fuels.

8.1.9 The Contractor shall operate, maintain, modify, and calibrate analytical instrumentation and ancillary equipment in the EPA MSDRL. The Contractor shall maintain a file of operating manuals for all equipment and instruments. Equipment and instruments included in this Task are listed in Attachment 2 (note that the 'Needed' column has changed quantities from the previous option period).

8.1.10 The Contractor shall maintain a complete and up-to-date inventory for the MSDRL along with Material Safety Data Sheets for all chemicals and gases.

8.1.11 The Contractor shall supply to the WAM on a monthly basis a written progress report that includes: (1) a list by run number of the dynamometer tests completed; (2) a list by identification number of the samples provided for analysis; (3) description of experimental procedure used and any observed anomalous behavior; (4) list of calibrations completed with the date of each instruments calibration respectively, and (5) a general description of laboratory operations. The Contractor shall also provide to the WAM electronic copies of raw data sets.
and recording substrate weights.

8.1.12 Provision of Spares, Parts, Equipment, and Instruments
Attachment 2 provides a list of required parts, components, equipment, and instruments. Additional parts, components, equipment, and instruments may also be required as directed by the WAM. These parts, components, equipment, and instruments must be directly applicable to the function of the light-duty, heavy-duty, small engine, or portable dynamometers and their sample systems.

a. The Contractor shall provide adequate spares, parts, equipment, and instruments to perform the weekly dynamometer emissions tests.

b. Spares, parts, equipment, and instruments will include but are not limited to those listed in Attachment 3.

Work Assignment Manager (WAM): Thomas Long
Alternate WAM: Richard Baldauf

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW) FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function; 07/14/08 A-2
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

□ **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

□ **QAPP Requirements for Software Development Projects**

□ **QAPP Requirements for Method Development Projects**

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

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NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-31

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Analytical Lab Support for Phy

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Michael Hays (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3984 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature)	3-27-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

I. **Title:** Analytical laboratory support for the physical and chemical characterization of organic gases and PM2.5

II. **Background:** The Air Pollution Prevention and Control Division's (APPCD) Emissions Characterization and Prevention Branch (ECPB) conducts research on fine particulate matter (PM2.5) and aerosol emissions as they pertain to the implementation of the National Ambient Air Quality Standards (NAAQS). Measurement of the physical and chemical properties of both gas- and particle-phase emissions is a research priority for ECPB. These measurements are used as input to National emissions inventories and to establish global air quality trends and understand related public health effects. Chemical source profiles are also used in source-receptor models that apportion ambient gases and PM2.5 to various anthropogenic and natural emissions sources. NRMRL-ECPB aims to characterize gas- and particle-phase source emissions and to develop and evaluate methods to measure and prevent these emissions. This Work Assignment seeks to update and upgrade source emissions profiles and PM2.5 mass emissions factors while improving the quality of data used for dispersion and source-receptor modeling and for evaluating current risk management and regulatory strategies.

In sum, the objectives of this project are to physically and chemically characterize source-related gas and PM2.5 samples for: (i) improving chemical source profiles; (ii) accurately apportioning ambient organic matter; (iii) improving fine PM mass and individual gas and PM component emission factors; and for (iv) supporting health and toxicological research.

III. **Work Assignment Objective:** The objective is to provide the Fine PM Characterization Laboratory (FPMCL) technical support for the chemical characterization of PM2.5 filter samples collected from a variety of important sources, especially, but not exclusively, combustion sources. Support for semi-volatile organic compounds (SVOCs) and gas-phase samples collected on polyurethane foam plugs (PUFs), SUMA canisters, or similar devices shall also be provided. The contractor shall be responsible for the characterization of (1) gas- and particle-phase emissions from residential- and industrial-scale boilers and (2) samples from emissions tests conducted with jet engines and with vehicles or generators burning diesel, bio-diesel, and ethanol-gas fuel blends. Characterization of near-source samples including those collected near roadways, biomass burning, industrial or commercial activities or similar polluted environments shall be necessary. Before analysis of any sample set the contractor shall seek the technical direction of the WAM task manager. In some cases, the WAM task manager will direct the contractor to provide samples to other authorized laboratory personnel for specialized sample analysis. An additional objective shall be to provide the WA task manager with a written report on a monthly basis or upon completion of the chemical and physical characterization of an emissions source.

IV. **Scope-of-Work:** In fulfillment of the objective of this Work Assignment, the following Tasks listed below shall be performed by the Contractor, and throughout the course of performing these Tasks, the Contractor shall comply with (1) the FPMCL Quality Assurance Project Plan (QAPP) entitled Chemical Analysis of Fine Particulate Matter, Revision #9, dated April 2012, (2) all its addendums and (3) the FPMCL Facility Manual. All work will be conducted using these existing documents. Moreover, the contractor shall follow all issued standard operating procedure (SOP), chemical hygiene, and Laboratory related health and safety plans.

V. **Tasks:**

In accordance with laboratory protocols established by the EPA for analysis of volatile and semi-volatile organic gases and PM2.5 samples, the contractor shall acquire laboratory supplies and consumables needed to accomplish the technical laboratory support work described below. The analytical protocols will be provided to the Contractor by the EPA Work Assignment Manager prior to initiation of the technical work.

A. The contractor shall determine the purity of each new lot of extraction solvents and, as necessary, purify any solvents that may be contaminated by commercial practices. The solvents shall be of sufficient purity to enable extraction and analysis of the samples and shall not contain interfering contaminants that may detract from the Data Quality Objectives of the project. The Data Quality Objectives are specified in the project QAPPs as stated above. The purity of the solvent shall be documented by the contractor and identification of the solvent lot used for sample extraction shall be reported by the contractor. The contractor shall include this information in the monthly written progress reports. Or this information shall be contained in the final report written for each source following the completion of its characterization.

B. The contractor shall clean substrates, sampling train components, and sample containers for collection of gases, liquids, and PM2.5, for field deployment, or for in-house sampling campaigns. Sample substrates and blanks may include Teflon membrane and quartz fiber filters, XAD-coated annular denuders, aluminum foil, XAD impregnated quartz filters, PUF

(polyurethane foam plugs) and various SUMA canisters. Also, the contractor shall provide clean glassware for use in the analyses of the PM samples. Decontamination methods will involve various solvent rinses and/or high temperature thermal removal of contaminants as described in the facility manual.

C. The contractor shall condition and weigh Teflon filters and Al foil substrates before and after PM sample collection in accordance with established EPA weighing procedures and quality control.

D. The contractor shall maintain a sample custody log of samples submitted for analysis following sample collection. For the vast majority of cases, it shall be necessary for a number of individual samples from a single source to be composited, thereby requiring careful recording of the composited samples. Before samples are composited, the contractor shall notify the WAM of the intention to do so. The WAM will also notify the contractor of the analytical method to be applied prior to analyzing any sample set.

E. Using protocols established and supplied by the EPA Work Assignment Manager, the contractor shall perform solvent or thermal extractions of particulate matter and semi-volatile organic matter samples collected on various media substrates. Samples shall be prepared so that analyte concentrations are appropriate for precise and accurate quantitative analysis of individual trace organic compounds and major inorganic ions. Once the individual species are identified and quantified in the PM mixture, the contractor shall report the raw and processed data and appropriate proof of the data quality to the WAM. The contractor shall also be responsible for running library searches on chromatographic data for the tentative identification of organic molecules in the PM extracts. The results of each search shall be reported by the contractor and compared against an appropriate blank to ensure validity. For quantified compounds, the contractor shall report whether (1) standards were available, (2) the compounds were within the calibration range, (3) the quantified compounds were above or below minimum detectable or quantifiable levels, and (4) the type of model used to fit calibration data. The contractor shall perform an identical set of functions for the gas-phase pre-concentration system used to analyze volatile organic compounds (VOCs), many of which are hazardous air pollutants.

F. Following a procedure established and provided by the EPA Work Assignment Manager, the contractor shall perform derivatization of polar organic compounds that enables quantitative resolution of such compounds via gas chromatography/mass spectrometry. Suitable standards shall also be derivatized by the contractor and used to (1) estimate deuterated standard recoveries (by making multiple GC/MS runs of the deuterated standards during a sample run sequence) and (2) to populate appropriate calibration database levels. Documentation of data quality for the derivatization steps shall be performed by the contractor. This data quality documentation shall be linked to specific PM extract samples analyzed by GC/MS. The contractor shall purchase derivatization equipment needed to conduct *on-line* or *in-situ* methylation and silyatoin experiments. Purchased equipment shall be compatible with the GC-MS technology and instrumentation available in the FPMCL and shall include an auto-sampler device.

G. The contractor shall provide for appropriate handling and disposal of all laboratory waste solvents and other laboratory waste materials.

H. The contractor shall operate, maintain, and modify, as necessary, analytical instrumentation and ancillary equipment in the EPA FPMCL. (Note: this Task includes ensuring appropriate instrument gases are provided (e.g., He, H_2, N_2, and air). The contractor shall maintain a file of operating manuals for all equipment and instruments. Equipment and instruments included in this Task are:

- HP-7890/7000 Auto sampler/Gas Chromatograph/MSD (qqq) in Room E580-A
- HP-6890/5793 Thermal extraction unit/Gas Chromatograph/MSD/FID in E580-A
- HP-6890/5793 Thermal extraction unit/2-dimensional Gas Chromatograph/MSD/ in E589-A
- HP-6890/5793 VOC pre-concentrator (ENTECH Inc) Gas Chromatograph/MSD/ in E288
- HPLC-MS (Q-TOF) and N_2-generator in E589
- Zymark TurboVap solvent concentrator in E580-A
- Cryofreezer in E580
- Fisher Isotemp muffle furnance in E569
- Skutt ceramic kiln in E578-A
- Nuaire horizontal clean bench in E578-A
- Sunset Thermal-Optical Elemental/Organic Carbon Analyzers in E-581-A and E589
- Thelco convection oven in E581-A
- Ainsworth semi-micro balance in E581-A or high-bay area
- Dionex 120 ion chromatograph in E581-A
- Sartorius MC5 microbalance in E580-A
- Cahn ultra microbalance in E580-A

- Terra Universal modular clean room in E580-A
- Dracor water purification system in E581-A
- Frigidaire commercial freezer and additional cryo-freezer units in E578
- Domnic-Hunter hydrogen generators (2) in E581-A

L. The contractor shall maintain a complete and up-to-date chemical inventory for the FPMCL Facility along with Material Safety Data Sheets for all chemicals.

M. The contractor shall update, as needed, the Facility Manual for the PM2.5 Analytical Facility which includes as a minimum the following items:

- General facility lay-out
- List of equipment by name, serial and model no, custodial account ID, EPA decal no., and location
- Computer software and hardware
- Safety/Health protocols
- Quality Assurance and Control protocols
- Sampling and Analysis Methods (ASTM, EPA, Miscellaneous Operating Procedures)

N. With the exception of the miscellaneous operating procedures (MOPs) for cleaning sample substrates, laboratory glassware, and sampling train components for which the Contractor shall be responsible, the QA/QC protocols, analytical protocols, and other MOPs will be provided by the EPA Work Assignment Manager for incorporation into the Facility Manual. The Facility Manual is a working document and will incorporate new material as protocols are established or modified and additional equipment is acquired.

O. The contractor shall supply to the WAM on a monthly basis a written progress report that includes: (1) a list by identification number of the samples analyzed; (2) the type of analysis done; (3) the results and data analysis; (4) an interpretation of the meaning of the results; (5) future work planned in the laboratory; (6) proof of data quality; (7) description of experimental procedure used and any observed anomalous behavior; and (8) description of laboratory operations; The contractor shall also provide to the WAM electronic copies of completed data sets and data analysis by source. In the event that the analysis of sample substrates from a single test source are completed, the contractor shall produce a written report describing the results of the analysis, the source sampling test conditions, and any other pertinent particle sizing and/or counting data.

VI. **Labor mix**: To achieve the objectives of the WA the following labor mix is required: (1) a person with extensive experience in chemical analysis using chromatography (GC-MS/FID, LC-MS, etc.). This individual shall have at least 15 years of GC-MS experience and be familiar with the extraction and pre-concentration procedures used for PM and miscellaneous organic gases. This individual shall be responsible for GC-MS (qqq) analysis and interpretation of GC-MS data as stated above. This person shall be capable of following all the required QA/QC procedures established in the QA protocol and shall be required to communicate results to the WA task manager. This individual shall also be responsible for certain research pursuits as they relate to the analysis of GC-MS data, including library searches and the application of identified deconvolution algorithms. The contractor shall ultimately be responsible for all of the GC-MS data quality provided to the WA task manager.

VII. Equipment purchase: The contractor shall look into the possibility of further automating the micro-solvent extraction, filtering, and concentration techniques. In consultation with the WAM, the contractor shall purchase technology that improves the analytical sample throughput or speed at which these steps can be conducted. Additional sampling equipment shall also be purchased in the event there is a need to complete a project in a timely manner.

VIII. **Deliverables**: The contractor shall deliver: (1) a data report containing chemical results from testing of aerosols and (PUF) gases emitted from a series of dynamometer tests conducted with multiple biodiesel fuel blends (due on or before December 15, 2013); (2) a finished data spreadsheet and analytical description that includes the composition of organic particles and gases emitted from prescribed fire and peat combustion experiments performed in the field and in an on-site burn hut (due on or before October 31, 2013); (3) proof of installation of a thermal extraction and automatic extraction tube handling device on a GC-MS (q) (due on or before June 15, 2013); (4) Evidence of extraction method development for diesel PM matrixes including comparisons to NIST-certified reference values and similar studies performed (February 28, 2014).

Scope of Work - FY 2013-2014
Period of Performance: 04/01/2013 – 03/31/2014
Work Assignment Manager (WAM): Scott A. Moore
Work Assignment Title: Biomass Burning and Biogenic Particle Measurement
QTRAK Number: 00045
Contract Number: EP-C-09-027
Work Assignment Number: 4-32

BACKGROUND

The Air Pollution Prevention and Control Division (APPCD) natural emissions sources team has been funded to perform emission characterization and chemical profile analysis of major particle and trace gas emission sources. The focus of the following tasks will be to further develop and implement field sampling techniques to capture particle and trace gas samples from biomass open burning, natural biogenic processes, and agricultural activities. We will examine trace gas and particle concentrations and composition above biomass fires, forest canopies and agricultural areas to better understand these source contributions to ambient particulate matter (PM) concentrations. This may include development of portable and remotely controlled sampling platforms capable of drawing large volumes of smoke from *in situ* fires and ambient air above forests. We will specifically target forested ecosystems in North Carolina, including forested eastern peatlands, mixed hardwood/pine forests and longleaf pine/wiregrass. Field tests conducted in 2011 indicate that emission factors for PM and carbon monoxide (CO) are very uncertain and likely to be biased low or poorly represented in current emission models. Our emphasis will be in preparation for testing of wildfire emissions from areas dominated by organic soils. Controlled enclosure studies in laboratory environments may also be necessary to analyze emission controlling processes.

This Work Assignment will provide field measurement methods development and database management support to characterize carbon dioxide (CO_2), CO, methane (CH_4), volatile organic compounds (VOC), and PM so that emissions from important forest fuel components (including combustion of organic soils) will be characterized. This will also allow mass balance calculations to be performed so that fluxes of co-sampled trace gases (including dioxins, bromomethane (CH_3Br), chloromethane (CH_3Cl), and possibly mercury (Hg) may be determined by other APPCD, National Health and Environmental Effects Research Laboratory (NHEERL), and National Exposure Research Laboratory (NERL) collaborators. This Work Assignment will also provide technical support for nitrous oxide (N_2O), ammonia (NH_3), ammonium (NH_4^+), biogenic aerosol, and biogenic organic trace gas sampling.

It is generally thought that emission factors or pollutants are among the more consistent and reliable components of biomass burning emission models. However, comparisons of recent studies suggest that under some conditions, especially where smoldering combustion is important, emission factors (EF) are still quite uncertain (Andreae and Merlet, 2001 in Global Biogeochemical Cycles; Hays et al., 2002). Residual smoldering combustion (RSC) emissions in deep organic soils can persist for weeks to months. Limited observations suggest that RSC is a

globally significant source of emissions to the troposphere (Bertschi et al., 2003 in Journal of Geophysical Research). These authors used a model which predicts trace gas EF for fires in a wide variety of aboveground fine fuels. It failed to predict emission factors for RSC. For many compounds, the EF for RSC-prone fuels is very different from the EF for the same compounds measured in fire convection columns above forest ecosystems. Some large changes resulted in estimates of biomass fire emissions with the inclusion of RSC. For instance, EF increases by a factor of 2.5 even when RSC accounts for only 10% of fuel consumption. This shows that many more measurements of fuel consumption and emission factors for RSC are needed to improve estimates of biomass burning emissions. This is especially true for fire in organic soils on the southeastern United States coastal plain.

Recent Congestion Mitigation and Air Quality (CMAQ) analyses have also highlighted the need for improved seasonal biogenic volatile organic compounds (BVOC) emission estimates. These ozone and secondary organic aerosol (SOA) precursors include, but are not limited to, isoprene, monoterpenes, sesquiterpenes, and oxygenated BVOC. We will conduct field studies to address these issues as well.

Task 1

Recent PM and gas phase EF have been described in Geron and Hays, 2013 (*Atmospheric Environment*). These studies were conducted in the field and in controlled environments. This data from the 2013 Article suggest that PM EFs from the combustion of organic soils ranged from 30-80 g kg^{-1} (fuel dry weight), which is 2-8 times greater than EFs from other fuels. Organic soil consumption may also be many times greater than above ground fuel consumption, and additional data for trace gases such as NH_3, nitrogen oxides (NO_X), and organic compounds from organic soil fuels are needed.

APPCD received funding from the U.S. Department of Interior Fish & Wildlife Service through the Joint Fire Sciences Research Program to conduct research related to these tasks. More detail is given in the proposals: ***"Development and Demonstration of Smoke Plume, Fire Emissions, and Pre- and Post Prescribed Fire Fuel Models on North Carolina coastal Plain forest Ecosystems"*** and ***"Predicting Prescribed and Wildland Fire Smoke, Emissions, and Fire Characteristics in Deep Organic Soils"*** The contractor has copies of the research plans summarized within these proposals. The contractor shall follow the guidelines within the proposals to continue the enhancement and testing of portable continuous sampling systems used in the field by the WACOR. Revision and enhancement to the continuous VOC and CO measurements shall be an emphasis.

The objective of the proposal is to develop and calibrate field methods which will be used to provide sample materials from prescribed fires (Rx) and wildfires where soil combustion may occur. The Contractor shall evaluate backpack portable and remote sampling platforms such as remote controlled helicopters and small unmanned blimps for application to this testing need. The Contractor shall consider smoke plume age, particle filter loads; trace gas collection, sample

package weight, payload, and cost in developing these systems. The Contractor shall submit the initial plans to the Work Assignment Contracting Officer Representative (WACOR) for review within 30 days after any critical samples have been analyzed. The WACOR will issue a Technical Directive (TD) if more time will be needed. Sample criteria are further described in tasks 2 and 3 below.

Test fires will take place in Environmental Protection Agency (EPA) burn hut facilities in summer of 2013. The WACOR will also monitor emissions from 1 or 2 fires on coastal plain peatland forests using a portable sampling system and rack-mounted instrumentation in the truck discussed in Task 3. The portable system system currently includes a LICOR™ 840 CO_2 and water vapor (H_2O) analyzer, a sulfuric acid (H_2SO_4) reaction CO detector, and a Photovac™ portable flame ionization detector (FID) for total volatile organic compounds (VOC). Upstream of the gas analyzers are a temperature probe and two cylone inlet $PM_{2.5}$ collectors for quartz fiber or Teflon particle collection sampling rate at 5 liters per minute (LPM). The Contractor shall compare performance of the continuous measurements of photochemically active and radiatively important trace gases as well as PM emissions from simulated R_X burns by comparing measurements from similar fuels in the EPA burn hut. At a minimum, continuous estimates of CH_4, total non-methane hydro carbons (NMHC), CO, CO_2, SO_2, and particulate matter of 2.5 microns or less ($PM_{2.5}$) shall be tested using independent calibrated continuous Emissions Monitors (CEMs) that the contractor shall install in the mobile sampling truck discussed in Task 3. The CO measurements from small sulfuric acid reaction detectors currently used in our portable smoke sampling packages can be relatively slow to respond to rapid changes in concentrations, so the effects of this lag should be determined by comparison with gas filter correlation methods.

The Contractor shall quantitatively analyze these samples to determine emission factors for individual trace gases and particles. These will be compared with EFs from the field burns by the WACOR. The Contractor shall provide the WACOR with quartz fiber filter smoke samples from the test fires. These will be used by APPCD to test source apportionment chemical fingerprints from these fires similar to Hayes et al., (2002, ES&T). This will allow us to assess these signatures by comparison with *in situ* data.

The Contractor shall calculate emission fluxes from the concentration data using mass balance techniques for the simulations. The WACOR will also be conducting simultaneous trace gas and $PM_{2.5}$ measurements using the separate and independent lightweight portable system for comparison.

Deliverables: Within 3 months following each burn, the Contractor shall deliver to the WACOR a report (in MS Word format) and database (in Excel format) of the continuous particle and trace gas measurements from test fires.

Task 2

If it is determined by the WACOR that additional test burn (controlled environment, "burn-hut"

experiments) data are needed, the Contractor shall conduct controlled burning emission sampling using the facilities described above. It may be necessary to acquire additional eastern NC fuels such as peat soil of composition varying from that examined in Task 1, or longleaf pine/wiregrass fuels commonly burned in wildfires or Rx burns. These shall be acquired by the Contractor and tested (at least two replicate samples of each) if need is determined by the WACOR. **Small samples (approximately 20-40 grams) shall be weighed, oven dried (at 80 to 90°C) for 48 hours to constant moisture content, and re-weighed by biomass component (e.g. decomposed organic matter, humus, stems/leaves/twigs, other) to gravimetrically determine moisture content prior to burning.** The contractor shall conduct Proximate/Ultimate analysis of the fuels prior to burning to determine carbon (C), hydrogen (H), nitrogen (N), sulfur (S) and moisture composition of the fuels. Emissions of CO_2, CO, methane (CH_4), $PM_{2.5}$, particulate matter of 10 microns or less (PM_{10}), NOx, NH_3, sulfur dioxide (SO_2), and VOC will be collected by the Contractor in collaboration with APPCD staff using the dilution sampler (if needed) as prepared by the APPCD Emissions Characterization and Prevention Branch (ECPB). Biomass sample size, fuel moisture/array, and burn time shall be planned such that PM filter samples will contain a minimum of 1 mg of material needed for PM chemical characterization by the APPCD. Thus far, sample size (for each individual test burn) needed to ensure adequate PM sample mass is approximately 12 kg @~14% moisture content. Furthermore, individual emissions samples should be collected during both flaming and smoldering stage of each fuel bed type. Continuous monitoring of CO_2 and CO will provide useful information on flaming and smoldering phases during the course of the burns.

The Contractor shall collect the Fine PM samples on 37 mm diameter quartz filters. The Contractor shall receive these filters from APPCD staff and deliver them back to APPCD staff within 24 hours after collecting the samples. APPCD staff will analyze these filters for fine particle composition. These filters are to be handled by sterile forceps in order to avoid contamination. The APPCD staff will deliver the test data to the WACOR for analysis. Complete details for handling the PM samples are found in the memo regarding "**PM-2.5 samples for source apportionment**" dated March 9, 1999. This information has been supplied to the Contractor.

Deliverables: Within 2 months following each burn, the Contractor shall deliver to the WACOR a report (in MS Word Perfect format) and database (in Excel format) summarizing particle and trace gas emission fluxes from each phase of each fire. The atmospheric conditions during each burn shall be reported in addition to fuel consumption, fuel moisture, and a description of the fuel array prior to burning.

Task 3.

This task supports ambient and Teflon bag enclosure measurements of C_2-C_{16} BVOC. The Contractor shall re-install the tube desorption and preconcentration system that was recently moved from Lab D475 to its current location in the Biogenics Laboratory in E-584. This is a custom designed (by Bob Arnts, recently retired from EPA NERL) and built system and is integrated with an Agilent 5975C Mass Spectrometer and Agilent 6890 Gas Chromatograph.

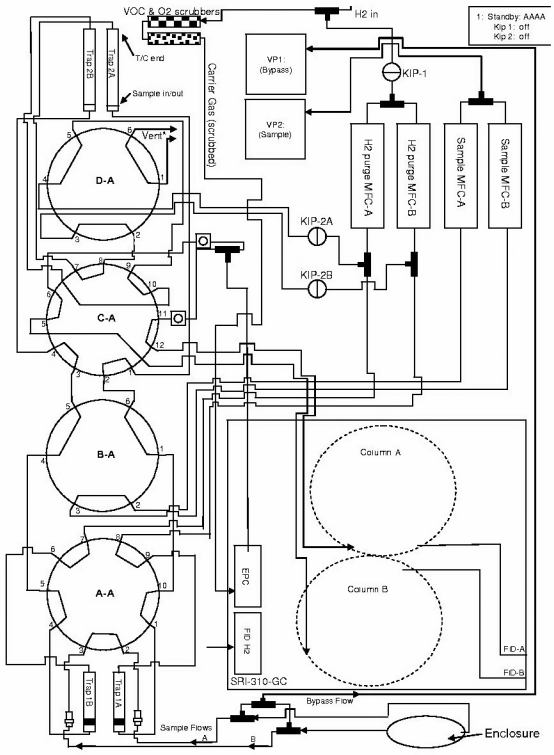
Upon completion of power installation, the desorption/preconcentration system shall be restored to its original operational state and integrated with the standard calibration system and CG/MS. The contractor shall perform standards calibration and ensure proper functionality of the system.

The Contractor shall assist in the application of an existing SRI Instruments gas chromatograph with a flame ionization detector (GC/FID) system to allow sampling directly from ambient air or vegetation enclosures. The SRI GC/FID system is currently located in Lab E584 where it has been modified by the WACOR and Ryan Daly. It will be moved to Lab E584 where it can be used to analyze plant emission samples from a Conviron environmentally controlled growth chamber. It is a dual channel system with a two stage preconcentration unit consisting of parallel ¼" traps packed with carboxen and carbopack B (**changed on Feb 25, 2010 to Tenax TA followed by Carbopack**) followed by 1/8" traps with Carboxen, Carbopack B and Tenax TA. Dual metal MXT® 30 meter columns are followed by FID detectors. The system should be calibrated for a list of biogenic VOC to be provided by the WACOR. The GC will be used to determine concentrations in ambient samples collected for the purpose of determining ambient VOC concentrations and emissions from vegetation. In addition to the necessary hardware modifications, the Contractor shall develop suitable injection and calibration methods. Descriptions of the system are attached.

For mobile applications of this 2 channel GC system, the WACOR has acquired a mobile laboratory vehicle. The contractor shall finish wiring upgrades to this mobile lab to provide 120 Volt AC power from line service as well as a 1250 Kw diesel generators recently acquired under WA 2-32. Installation of an air conditioning unit (also provided by the WACOR) will also be necessary. The contractor shall rack mount NO_X, sulfur oxide (SO_X), CO and ozone (O_3) instruments in the vehicle. The contractor shall calibrate these instruments for analyte concentrations relevant for remote ambient to fire environment situations. The instrument racks will be supplied by the WACOR.

Notes on GCMS drawing

- Valves A,B,C,D, and E are 10, 6, 12, 6, and 12 ports (two position) valves respectively. E is a manual valve inside the GC to switch between DB-1 and Plot columns.
- A and B are 1/8", and C,D,E are 1/16" Valco fittings.
- Valve States: Connecting ports 1-2, 3-4, 5-6 etc. is state "B", and connecting ports 10-1, 2-3, 4-5, 6-7, etc. is state "A". Default positions (no power) is A for valves A,B and D and position B for valve C. These are switched through 1 solid state and 1 mechanical, non-latching relay per valve.
  - Step 1: AAAA Standby, initialize valve positions, isolate traps, stabilize flows
  - Step 2: BBAA Sample collection
  - Step 3: BAAA H2 purge of stage 1
  - Step 4: AAAB transfer 1→2
  - Step 5: AAAB→AABA Stage 2 injection into GC
  - Step 6: BAAA Bakeout, backflush
- H2 lines are colored by:
  - Red-directly out of scrubbers
  - Red-dashed-from GC pressure control
  - Purple-non-scrubbed (for FID H2)
- Columns A1 and A2 are PLOT (0.32mm ID, 25m length, 8µm film thickness)
- Columns B1 and B2 are DB-1 (0.32mm ID, 30m length, 0.5µm film thickness)
  - Need to check on film thicknesses - I don't have them in front of me.
- Columns A1/B1 is split so that part of the flow is directed into MSD through 0.1mm heated transfer line (deactivated fused SiO2).
- See Excel spreadsheet "gcms_states" for valve states, flow rates, and temperatures for each of the steps.



A portable GC/MS has also been acquired by the WACOR for use on this task. It consists of a Inficon ER unit which has a Rtx-1MS column (100% polydimethylsiloxane, 1µm df , 15 meter length, 0.25 mm i.d.) in a temperature programmable oven (to 200°C). Preconcentration is performed by drawing sample at 100 ml min^{-1} through a tri-bed trap consisting of Carbopack Y, Carbopack X, and Carboxen 1018. A single bed preconcentrator packed with Tenax TA is also available. The WACOR is currently calibrating this system for BTEX, BVOC and other compounds commonly found in biomass smoke. It will also be used to identify other compounds not currently in our databases.

The Contractor shall assist in the maintenance and calibration of an existing GC/ECD system to allow sampling from 50ml syringes, similar to the existing APPCD N_2O system. The GC will be used to determine concentrations in ambient samples collected for the purpose of determining emissions from soil.

Task 4.

The WACOR will deploy a Sunset semi-continuous OC/EC aerosol analyzer at the Duke Forest Blackwood Division Research Facility (FACTS1) experiment at Eubanks Rd in Orange County, NC. The Contractor shall collect continuous 3 hour min samples on the OC/EC instrument with the system inlet located at the top of the Ring 6 central walkup tower. The Contractor shall collect these data continuously for 12 months.

Operational details are from Geron (2009) and are as follows:

Organic and elemental carbon in $PM_{2.5}$ (OC and EC respectively) are quantified using an automated semi-continuous thermal-optical analyzer (Sunset Laboratory, Beaverton, OR, USA). Ambient air is drawn at 8 L min^{-1} through a 2.5 um aerodynamic diameter cut point cyclone (BGI, Inc., Waltham, Massachusetts, USA) located 3-5 m above the pine canopy at the center of Ring 6. The cyclone is followed by a parallel-plate (20.3 x 3.2 cm) carbon impregnated fiber denuder (Sunset Laboratory, Beaverton, OR, USA) to remove gas phase organic compounds. $PM_{2.5}$ in the airstream deposits on a 17 mm circular quartz fiber filter (double thickness for reinforcement). The filters are held in place by a quartz tube through which the ambient air is passed. Upon completion of the collection period (typically 167 min.), air is purged from the system and the filter is heated in an Ultra High Purity (UHP, >99.9995%) He atmosphere to 650°C and held for ~ 0.5 min, then heated to 850°C, held for 1 min to complete the thermal step for releasing OC. The oven containing the filters is then cooled to 650°C, and the carrier gas is then switched to 10% O_2 in He. The oven temperature is again increased to 850°C to oxidize and volatilize EC and residual char formed during heating of the OC in the previous steps. As the oven cools, an external calibration is performed by injecting 1 ml of 5% CH_4 in He. At 760 tor and 298°K, this standard injection contains 24.54 μg of carbon. The carbon from the external standard or that volatilized from the filter is converted into CO_2 as it passes through a MnO_2 catalyst. The CO_2 is then quantified by a non-dispersive infrared (IR) detector (RMT ltd., Moscow, Russia). The split between OC and EC is determined by laser correction. A tuned diode red laser beam (660 nm) is passed through the filter during sampling and analysis. After sample collection and prior to the initial temperature increase, laser absorbance is recorded. Charring of OC on the filter can increase absorbance during the initial temperature increase in the He environment. During the second heating stage in the He/O_2 stream, elemental carbon is oxidized off of the filter and red light absorbance decreases. When absorbance decreases to its initial value, the "split point" is reached, and carbon that evolves after this split point is classified as elemental. Peaks integrated prior to the split point are classified as OC. This process is illustrated in a typical thermogram below.

During the sample collection period, the front oven containing the sample filters is typically 10-20°C above ambient temperature. No correction is applied to account for possible loss (if any) of SVOC from the filter due to this heating. The thermogram in Figure 1 below suggests that this loss is likely to be negligible, since little carbon evolved from the filters at temperatures below 100°C.

The contractor may be required to upgrade the chassis of the Sunset OC/EC analyzer to upgrade valves and mass flow controllers and install a new NDIR detector. These upgrades will improve sensitivity and tolerance to hot summertime ambient conditions.

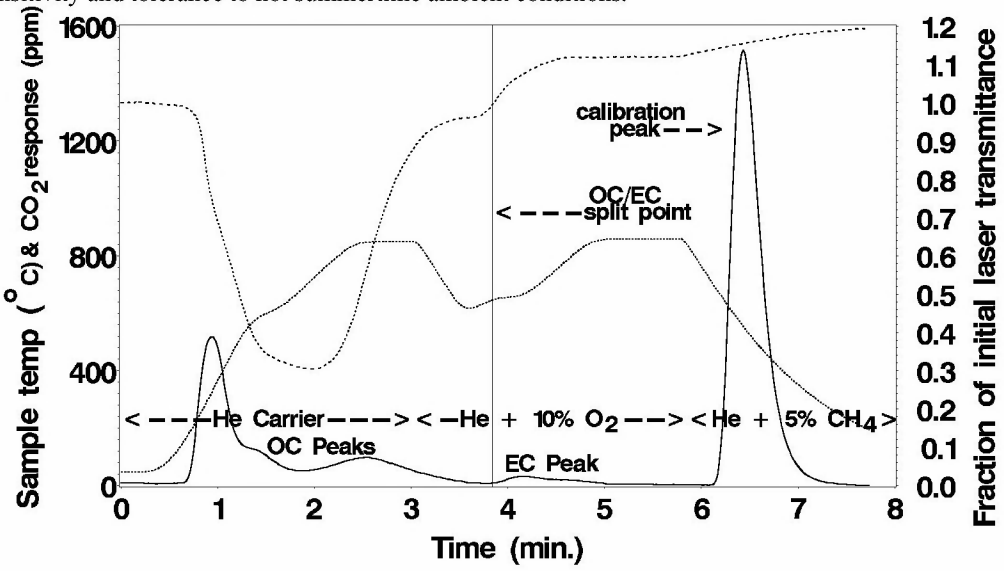


Figure 1. OC/EC Thermogram.

REFERENCES

Geron, C. (2009) "Carbonaceous aerosol over a Pinus taeda forest in central North Carolina." Atmosperic Environment **43**:959-969.

Deliverables: Upgraded Sunset OC/EC analyzer. Contractor shall deliver to the WACOR a report (in tab-delimited ASCII format) and database (in MS Excel format) summarizing the OC (organic carbon), EC (elemental carbon) CC (carbonate carbon), and TC (Total carbon) collected to check the performance of the upgrade.

Task 5.

The contractor shall integrate a TEOM-ACCU (cartridge sampling system) with the NOx and SO_2 instruments in the vehicle discussed in Task 3. The cartridge sampling systems should be set to sample to different cassettes containing 47 mm quartz fiber filters according to high vs low ambient NOx (~1 ppm cutoff) and SO_2 (~2 ppb cutoff) concentrations using the analogue output signals from the respective instruments to the ACCU analogue inputs. Once operational, this system will be operated and maintained by the WACOR at the MOFLUX site in Central

Missouri The WACOR will analyze quartz filters from this system for EC/OC/CC/TC (using Sunset Laboratories Instrument in EPA Lab E580A) content using the methods of Hays et al. (2002). Remainder of filter material shall be stored at sub-freezing temperature (-40°C) for later isotopic analysis and/or chemical tracer analysis as specified by the WACOR for individual filters. The WACOR will perform GC/MS and total carbon analyses on a subset of these filter samples. Methods are discussed in detail in Fan et al (2003, ES&T 37:14 pp 3145-3151).

The WACOR will submit approximately 6 samples (plus blanks) to the Contractor for ^{14}C analysis. The radiocarbon content will be used to estimate the relative amounts of fossil fuel and non fossil fuel related carbon in the atmospheric aerosol samples. The samples will consist of 47 mm circular quartz fiber filters from the TEOM-ACCU. The Contractor shall perform radiocarbon (^{14}C) analyses using the using the methods described below.

Filter Handling:

Using a clean pair of metal tweezers, remove any obvious extraneous objects that are clearly not $PM_{2.5}$ particles, (e.g., insect parts) from the filters. For all 47-mm dia filters, using a 40-mm diameter punch, punch out the interior aerosol deposit area of each filter, and discard the outer ring. Return filters to their Petri containers, seal with teflon tape, wrap with 2 layers of clean Al foil, and place together in a zip-lock bag.

The Contractor shall follow the General Statement of ^{14}C Procedures used at the National Ocean Sciences Accelerator Mass Spectrometer (NOSAMS) Facility. All laboratory preparations for AMS radiocarbon analyses of submitted samples occur in the NOSAMS Sample Preparation Lab unless otherwise noted on the attached report of Final Results. Procedures appropriate to the raw material being analyzed include: acid hydrolysis (HY), combustion (OC), or stripping of CO_2 gas from water (WS) samples. Carbon dioxide, whether submitted directly (GS) or generated at the NOSAMS Facility, is reacted with catalyst to form graphite. A Fe/H2 catalytic-reduction is used for all except very small samples, where a Co/H_2 catalytic-reduction is used. Graphite is pressed into targets, which are analyzed on the accelerator along with standards and process blanks. Two primary standards are used during all ^{14}C measurements: NBS Oxalic Acid I (NIST-SRM-4990) and Oxalic Acid II (NIST-SRM-4990C). The ^{14}C activity ratio of Oxalic Acid II ($\delta^{13}C$ = -17.3 per mil) to Oxalic Acid I ($\delta^{13}C$ = -19.0 per mil) is taken to be 1.293. Every group of samples processed includes an appropriate blank, which is analyzed concurrently with the group. Process blank materials include IAEA C-1 Carrara marble for inorganic carbon and gas samples; a Johnson-Mathey 99.9999% graphite powder for organic carbon samples; and a commercial tank of ^{14}C - free CO_2 for seawater samples. Fraction Modern (Fm) is a measurement of the deviation of the ^{14}C /C ratio of a sample from "modern." Modern is defined as 95% of the radiocarbon concentration (in AD 1950) of NBS Oxalic Acid I normalized to $\delta^{13}C$VPDB = -19 per mil (Olsson, 1970). AMS results are calculated using the internationally accepted modern value of $1.176 \pm 0.010 \times 10^{-12}$ (Karlen, et. al., 1968) and a final ^{13}C correction is made to normalize the sample Fm to a δ13CVPDB value of -25 per mil. Stable isotope measurements of sample $\delta^{13}C$ used to correct Fm values are typically made at the NOSAMS Facility by analyzing sub-samples of the CO_2 gas generated during graphite production with either a VG PRISM or VG OPTIMA

mass spectrometer. However, some carbonate samples are reacted and measured directly with the VG PRISM ISOCARB. The $\delta^{13}C$ value used to calculate the Fm of a sample is specified in the report of Final Results.

Reporting of ages and/or activities follows the convention outlined by Stuiver and Polach (1977) and Stuiver (1980). Radiocarbon ages are calculated using 5568 (yrs) as the half-life of radiocarbon and are reported without reservoir corrections or calibration to calendar years. For all sea water samples, where collection date is known, a $\Delta^{14}C$ activity which has been corrected to 1950 values is also reported. For other samples where $\Delta^{14}C$ is reported, we assume the collection and measurement date are the same and leave it to the submitter to make further age corrections. Atoms of ^{14}C contained in a sample are directly counted using the AMS method of radiocarbon analysis; therefore, internal statistical errors are calculated using the number of counts measured from each target. An external error is calculated from the reproducibility of individual analyses for a given target. The error reported is the larger of the internal or external errors. When reporting AMS results of samples run at the NOSAMS facility, accession numbers (e.g. OS-####'s) are required to be listed together with the results. The contractor shall tabulate OS-numbers and associated radiocarbon ages as they appear on the attached Final Report in addition to any subsequent corrections that may need to be made to the ages. The contractor shall acknowledge support from NSF by including the NSF Cooperative Agreement number, OCE-9807266, and send reprints or preprints of papers referencing AMS analyses made at the NOSAMS facility to them. Any sample material not consumed during sample preparation or AMS radiocarbon analysis is archived for two years at the NOSAMS Facility unless other arrangements are made by the submitter.

REFERENCES

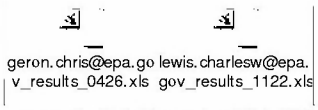
Karlen, I., Olsson, I.U., Kallburg, P. and Kilici, S., 1968. Absolute determination of the activity of two ^{14}C dating standards. Arkiv Geofysik, 4:465-471.

Olsson, I.U., 1970. The use of Oxalic acid as a Standard. In I.U. Olsson, ed., Radiocarbon Variations and Absolute Chronology, Nobel Symposium, 12th Proc., John Wiley & Sons, New York, p. 17.

Stuiver, M. and Polach, H.A., 1977. Discussion: Reporting of ^{14}C data. Radiocarbon, 19:355-363.

Stuiver, M., 1980. Workshop on ^{14}C data reporting. Radiocarbon, 22:964-966.

Deliverables: The Contractor shall provide instrument output files (in MS Excel or ASCII format) on a monthly basis for those CEMS deployed at the field sites, including (but not limited to) the TEOM-ACCU, CO, NO_X, SO_2, and O_3 monitors. The ^{14}C estimates for the filter analyses should provide uncertainty estimates and mean percent modern carbon in Excel format. The NOSAMS format is recommended and we include samples from previous sample collections and

analyses. 

The Contractor shall inform the WACOR if the above links do not work and the WACOR will provide copies of the above spreadsheets.

Comment [W1]: Is this suppose to be the NOSAMS format samples? Should the KTR be able to open these? I also attached copies to the email in case the link doesn't work. Can you add them to the WA?

Task 6.

The contractor shall revise the Quality Assurance Project Plan entitled "Quality Assurance Project Plan for Prescribed Fire Emissions Measurements", Revision 2 (or date), to include the activities described in Tasks 1-5. After revision, the QAPP shall be reviewed and approved by the ARCADIS work assignment leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the ARCADIS work assignment leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the ARCADIS work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and the EPA QA manager will review and approve the QAPP and they will add their signatures to the signature page. The WACOR has reviewed this plan and found it to be suitable for this proposed Work Assignment. The contractor shall adhere to the QA requirements as delineated in Attachment #1 to the Statement of Work. **Work shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.**

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW) FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function; 07/14/08 A-2
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

□ **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

□ **QAPP Requirements for Software Development Projects**

□ **QAPP Requirements for Method Development Projects**

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

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NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.

3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

Receipt #	Date_Repc	Kind	Type	Submitter_	Description	Process	NOSAMS /	d13C	d13C_Sou	Small?	F Modern	Fm Error
47228	4 / 26 /	Organic	Plant/Woo	Duke Fore	Pine need	OC	OS- 49054	-25	C	Assumed	0.717	0.0024
47229	4 / 26 /	Organic	Plant/Woo	Duke Fore	Pine need	OC	OS- 49055	-25	C	Assumed	1.0636	0.0038

Age	Age Error	D14C
2670	25	-287.7
>Mod		56.6

Receipt #	Date_Repc	Kind	Type	Submitter_	Description	Process	NOSAMS /	d13C	d13C_Sou	Small?	F Modern	Fm Error
44868	11 / 22 /	Organic	Other	Duke Fore	atmos. aer	OC	OS- 4694	-27.4	N	MEASURED	0.8957	0.0033
44872	11 / 22 /	Organic	Other	Duke Fore	atmos. aer	OC	OS- 4694	-26.33	N	MEASURED	0.8185	0.0029
44883	11 / 22 /	Organic	Other	Jenkins R	atmos. aer	OC	OS- 4694	-26.9	N	MEASURED	0.7919	0.0038
44884	11 / 22 /	Organic	Other	Jenkins R	atmos. aer	OC	OS- 4694	-27.02	N	MEASURED	0.8931	0.0032
44885	11 / 22 /	Organic	Other	Jenkins R	atmos. aer	OC	OS- 4694	-27.02	N	MEASURED	0.9027	0.0031
44886	11 / 22 /	Organic	Other	Jenkins R	atmos. aer	OC	OS- 4694	-26.33	N	MEASURED	0.8303	0.0035
44887	11 / 22 /	Organic	Other	Jenkins R	atmos. aer	OC	OS- 4694	-25.89	N	MEASURED	0.8417	0.0032
44888	11 / 22 /	Organic	Other	Jenkins R	atmos. aer	OC	OS- 4695	-27.01	N	MEASURED	0.9012	0.0029

Age	Age Error	D14C
885	30	-110.2
1610	30	-186.8
1870	40	-213.2
910	30	-112.7
820	25	-103.2
1490	35	-175.1
1380	30	-163.8
835	25	-104.7

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-33

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Lab Research on the Effectiven

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2):

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Contract Period:	Cost/Fee:	LOE:
	04/01/2009 To 03/31/2014		
This Action:			
Total:			

Work Plan / Cost Estimate Approvals

Contractor WP Dated:	Cost/Fee:	LOE:
Cumulative Approved:	Cost/Fee:	LOE:

Work Assignment Manager Name: Clyde Owens (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-1133 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates 5-14-13 (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Project Work Statement

Laboratory Research on the Effectiveness of Alkalized Hydrogen Peroxide of Methamphetamine and its Byproducts after Decontamination in Clandestine Laboratories

I. TITLE

Laboratory Research on the effectiveness of alkalized hydrogen peroxide for decontamination of methamphetamine and its byproducts after decontamination in clandestine laboratories.

II. PERIOD OF PERFORMANCE

The period of performance for this work assignment shall be from the date of award to September 30, 2014.

III. SUMMARY OF OBJECTIVES

The primary goal of this project is to continue examining the effectiveness of alkalized hydrogen peroxide (H_2O_2) for decontamination of methamphetamine and investigate the levels of risks from methamphetamine byproducts after decontamination of interior surfaces.

IV. RELEVANCE

The National Risk Management Research Laboratory (NRMRL) / Air Pollution Prevention and Control Division (APPCD) has an active indoor air research program that includes characterization and evaluation of remediation approaches. This research topic is actively supported by the Office of Research and Development (ORD). The data from this research will be used to inform the design of any follow-on studies related to indoor concentrations of methamphetamine and its associated compounds.

V. BACKGROUND

The production and use of methamphetamine continues to pose many challenges for our nation. Each year large quantities of methamphetamine are produced in illegal clandestine laboratories. Clandestine drug laboratory operators violate the Controlled Substances Act (PL 91-513) by manufacturing stimulants, hallucinogens, and narcotics. These laboratories present significant safety and health risks to law enforcement and to the public. Furthermore, these laboratories present significant environmental concerns due to the types of chemicals used to produce the drugs and waste generated. Methamphetamine production is associated with the release of chemicals, such as volatile organic compounds (VOCs), acids, and bases, in addition to methamphetamine itself. These methamphetamine contaminants are present in the air are absorbed or deposited on indoor surfaces, such as countertops, tiles, wallboard, and ventilation systems. Currently, remediation typically involves best management practices to restore former home methamphetamine labs for reoccupation. Each state has placed forward research needs to develop their own health-based procedures addressing characterization, remediation, and clean-up criteria issues. During methamphetamine synthesis, the fate and transport processes that lead to deposition of methamphetamine on interior surfaces have yet to be completely characterized. Based on current knowledge, it appears that one or more steps in the methamphetamine synthesis process generate an aerosol or vapor of airborne methamphetamine which is transported widely throughout the interior of a residence When the vapor contacts a surface, it condenses and forms a film, similar to film that deposits on surfaces when pesticides are applied using broadcast spraying or an indoor fogger. Since the film of methamphetamine generated during clandestine

methamphetamine synthesis is physically similar to the chemical film produced by indoor application of pesticides, models that have been developed to estimate indoor exposure to pesticide residues can also be used to estimate indoor exposure to methamphetamine residues.

VI. SCOPE

This work shall continue examining the effectiveness of alkalized vaporous hydrogen peroxide gas and liquid hydrogen peroxide (H_2O_2) for decontamination of methamphetamine on four different types of interior building material coupons such as galvanized steel duct, latex painted drywall, glass, and vinyl surfaces. Also, this work shall determine all oxidized methamphetamine byproducts and residual byproducts produced from decontamination.

VII. TECHNICAL APPROACH

The general test method for the decontamination tests is as follows: (1) apply methamphetamine solution onto test coupons via quantitative nebulization; (2) establish the target temperature and relative humidity for the test; (3) apply liquid hydrogen peroxide (LHP) onto coupon or charge the chamber with hydrogen peroxide vapor (HPV) to achieve the target concentration (*note:* hydrogen peroxide vapor for this effort will be generated using heated bubbler or flash evaporator method, not via Vaporized Hydrogen Peroxide (VHP®) STERIS's technology; (4) perform decontamination for the specified time and record environmental conditions (*note:* time zero for HPV is defined as the time at which the target concentration was achieved in the chamber); (5) aerate the chamber for a defined length of time and remove the coupons, placing them in the appropriate sample secondary and packaging containers for sampling and analysis. Methamphetamine residue from test coupons shall be sampled in-house using wipe-sampling technique and analysis shall be performed by the subcontracted commercial laboratory (EMSL Analytical, Inc., Cinnaminson, NJ, USA).

The efficacy of the alkalized hydrogen peroxide against methamphetamine deposited on test coupons representing various building materials shall be determined for each material type. The amount of remaining methamphetamine after LHP and HPV decontamination and the amount of the methamphetamine remaining on the positive control coupons (identical material methamphetamine-inoculated, but not decontaminated) shall be used to determine the efficacy. This efficacy ζ (as a percent) is described using the following equation:

$$\zeta = \left(1 - \frac{M_m \text{ on Test Coupon}}{M_m \text{ on Positive Control Coupon}}\right) \times 100\%$$

M_m = measured mass of methamphetamine (µg)

The amount of methamphetamine remaining on the surface shall be quantified via chemical extraction and subsequent Liquid Chromatography-Mass Spectrometry (LC-MS) of the extract

using modified NIOSH Method 9111 by the commercial laboratory. Non-detect values shall be considered equal to zero (the detection limit will be reported with each set of data). An amendment describing the details of the analytical procedures to be used shall be submitted to the EPA WAM upon completion of the method validation by EMSL Analytical, Inc. The validation will be performed after subcontracting laboratory receives the first set of samples from nebulization experiments (prior to analysis of the first batch of samples from decontamination tests).

VIII. TASKS

Preparation of the Coupons and Application of Methamphetamine Solution

The test coupons shall be prepared from each of four building materials: dry wall, vinyl, galvanized metal and glass to approximate dimensions of 10 cm x 10 cm under the WA 2-26 research efforts. The building materials used meet representativeness and uniformity criteria. Material representativeness means that these materials are typical of those currently used in buildings in terms of quality, surface characteristics, and structural integrity. Material uniformity means that all these material coupons are equivalent for purposes related to testing. In this effort representativeness shall be assured by selecting test materials that are typical of those found in residential dwellings and meet industry standards or specifications for indoor use, and by obtaining those materials from appropriate suppliers. Uniformity was maintained by obtaining a large enough quantity of material such that multiple test samples could be obtained with presumably uniform characteristics (e.g., test coupons shall be cut from the interior rather than the edge of a large piece of material if possible). Building materials and the process of preparing coupons are described below;

1. Galvanized metal: The galvanized steel for coupon preparation is of Dillon Precision Products Inc., USA (20 gauge). The heavy duty power hydraulic shears shall be used to cut the metal to the correct length and width.

2. Vinyl tile: The vinyl tile is representative of a standard 12'x12' tile used for residential buildings vinyl flooring (Jamesport Camel pattern, Armstrong World Industries, Inc., USA). Tiles shall be cut using hydraulic shears for the desired size.

3. Glass: The window glass is from RF Supply, Inc. (USA). Glass coupons shall be cut by hand using a glass cutter to obtain coupon size of 10cm X 10 cm (glass thickness 3/32 inch). The 40 grit sandpaper shall be used to file down the edges to reduce the risk of lacerations.

4. Dry wall: The dry wall material is a standard sheet rock (SHEETROCK, USA). Coupons shall be made using a table saw. The edges shall be sealed with Fast'n'Final® light weight

spackling (DAP Products Inc., USA), making sure that top surface is clear of spackling before priming and then painting. Primer was Kilz 2® latex primer (Masterchem Industries LLC, USA), paint was an Olympic premium flat in white (Olympic®, USA).

Coupons shall be cleaned with acetone to remove grease, etc, before methamphetamine application. The crystalline methamphetamine standard was purchased from Sigma-Aldrich (M8750-25g, crystalline methamphetamine hydrochloride, purity ≥ 98 %) under previous research efforts of WA 1-33. A stock solution of methamphetamine in methanol shall be prepared before application.

To emulate residue dispersion of methamphetamine in the field, a commercially available medical nebulizer shall be used to generate an aerosol. The nebulization shall be performed in the nebulization dome constructed under the WA 2-33 effort. The nebulization dome shall consist of Glove Bag ® inflatable glove chamber connected through the gas port to house air supply to inflate, medical nebulizer, 9V fan above the nebulizer, two 17'' turn tables (each turn table can accommodate ten 10 cm x 10 cm test coupons); Figure 1 shows the nebulization set-up (a) and release of methamphetamine aerosol (b).

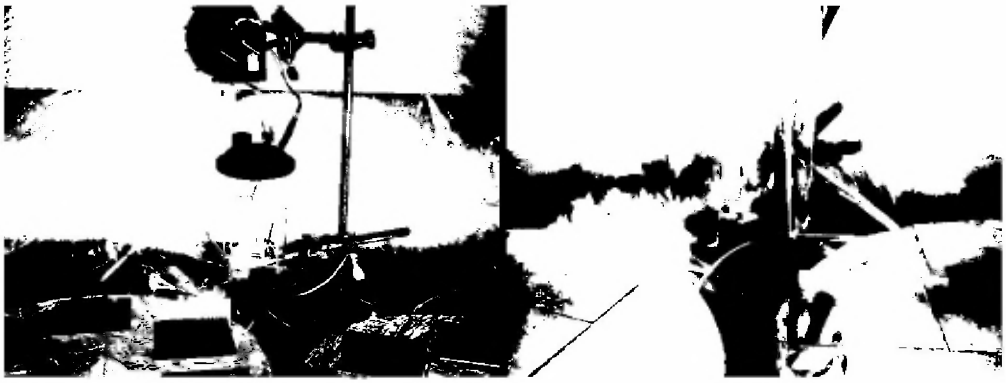

Figure 1. Nebulization set-up (a) and release of methamphetamine aerosol (b)

The accuracy and precision of methamphetamine concentration produced for each test material shall be verified through surface sampling of 5-7 coupons of each material. This shall allow an accurate account of residue that is spread over the surface of the coupon. After initial testing of methamphetamine delivery on four building surfaces, the standard operating procedures along with instrument operation parameters shall be covered in an amendment to the existing QAPP.

All coupons shall be placed in labeled secondary containers with lids for identification and to minimize contact with the coupon surface during transportation between chemical fume hood and air lock/glove box. Location of the coupons within the chamber shall be recorded in the laboratory notebook. A label shall also be placed on the packing containers before the coupon is placed into the shipping package. This label shall consist of a description of the coupon material and a unique sample number which shall correspond to the sample identity and specify test conditions.

Efficacy of Alkalized 15% Liquid-Liquid Hydrogen Peroxide Decontamination

The alkalization of hydrogen peroxide shall be performed in a glass 100 mL beaker containing 25 mL of 15% hydrogen peroxide. The beaker shall be placed in a larger beaker filled with ice cold water to allow absorption of heat possibly produced during the alkalization process. 15% hydrogen peroxide shall be prepared by dilution of 50% hydrogen peroxide in DI water. The pH of freshly prepared 15% hydrogen peroxide solution shall be measured using a pH-meter. The pH should theoretically be approximately 5 pH units, but due to presence of stabilizers and by-products from manufacturing process is expected to be more acidic (pH ~ 2.5 – 3.5). The desired pH of hydrogen peroxide for further methamphetamine decontamination experiments is approximately 8.5. Therefore, 15% hydrogen peroxide shall be slowly titrated with freshly prepared 0.1N sodium carbonate (pH = 11.6). Sodium carbonate solution shall be prepared from sodium carbonate concentrate. After each 0.5 mL addition of alkalizing agent, the pH measurement shall be performed until the hydrogen peroxide solution reaches pH of 8.5.

Prior to experiments on building materials decontamination, the pH-adjusted (alkalized) liquid hydrogen peroxide solution (15%) shall be used to decontaminate methamphetamine in the liquid-liquid stirred reactor test. This evaluation shall be performed in 50 mL conical centrifuge tubes, in which methamphetamine solutions in methanol shall be exposed to 15% pH-adjusted liquid H_2O_2 (pH~8.5) via sonication for 4h without the presence of the coupon material. The test matrix for liquid-liquid decontamination shall consist of:

1. Five test samples that shall undergo decontamination (2 mL of alkalized hydrogen peroxide shall be spiked with methamphetamine solution in methanol)

2. Five positive controls that shall not undergo decontamination (2 mL of methanol shall be spiked with methamphetamine solution in methanol)

3. One procedural blank (2 mL of alkalized hydrogen peroxide shall be spiked with methanol only)

Samples shall be sonicated for 4h. After 4h of sonication, conical tubes shall be opened and each sample shall receive one 4" x 4" cotton wipe pre-moistened with 2 mL of methanol. Samples shall be refrigerated immediately after sampling and sent to the subcontracting analytical laboratory for analysis within 24h in cooled containers. Two solutions of methamphetamine

(stock solution and diluted stock solution used for spiking) shall be sent for analysis along with test samples. Depending on the results from the liquid-liquid experiments, the decontamination with alkalized hydrogen peroxide shall be continued on non-porous and porous building materials nebulized with methamphetamine.

Experimental Setup and Decontamination of the Coupons

The contaminated coupons shall be decontaminated in the glove box located in H-210. The environmental parameters (relative humidity and temperature) shall be monitored for all LHP and VHP tests. Relative humidity and temperature in the chamber shall be measured using a Vaisala HUMICAP temperature and humidity sensor, model HMP50. The humidity sensor is factory preset to measure 0 to 98% (non-condensing) relative humidity. The accuracy of the sensor is ±3% at 0 to 90 % RH and ±5% RH at 90 to 98% RH. The temperature sensor is preset to measure from -10 to 60ºC with an accuracy of ± 0.6ºC.

For the liquid hydrogen peroxide tests, the exact amount of alkalized LHP of known concentration (15%) shall be applied using a refillable mini-sprayer or spray gun, to emulate "low-tech" hydrogen peroxide-based in *situ* decontaminations of clandestine methamphetamine laboratories. It is being assumed that for that type of operation oxidizing agent solution would be applied using a commercially available, industrial grade backpack sprayer. A flat spray nozzle shall be used to provide uniform coverage of test coupons. Spraying shall be carried out with straight uniform strokes moving across the surface of coupons in such a way that the spray pattern overlaps the previous stroke by a minimum of 50%. Once all the coupons are sprayed with LHP solution, the decontamination cycle shall be started. After 4 hours test coupons and procedural blanks shall be removed to the chemical hood, through the modified airlock (without affecting the chamber conditions). All coupons shall be left in the chemical hood until dry and then wipe sampling shall be performed.

The fumigations with alkaline hydrogen peroxide vapor shall be performed using a vapor generated using a heated bubbler or flash evaporator, depending on the desired concentration. In essence, a bubbler filled with alkaline hydrogen peroxide shall be sparged with air to generate the vapor. The temperature of the bubbler and the concentration of the hydrogen peroxide, as well as the amount of air bubbled through the system, shall be varied to meet on the desired vapor concentration. If very high concentrations are required, a flash evaporator may be used. Once the target concentration of high, median, and low (125, 250, and 400 ppm) has been reached and is stable for 30 minutes, the coupons shall be moved to the glove box chamber through the modified air lock and exposed to the alkalized hydrogen peroxide vapor. After 4 hours of exposure the chamber shall be aerated until the HPV concentration within the chamber reaches a safe level and coupons shall be removed to the chemical hood. All coupons shall be left in the chemical hood until dry and the wipe sampling shall be performed. HPV concentration within the chamber shall be monitored using a Analytical Technology Corp., hydrogen peroxide electrochemical sensor (model B12-34-6-1000-1) coupled with a data acquisition unit to provide real-time concentration readings as well as data logging capability. The sensor is factory preset

to measure from 0 to 1000 ppmv H_2O_2- with a sensitivity of < ±5% of the measured value. The sensor shall be calibrated prior to each test by placing over the head space of liquid hydrogen peroxide at a known concentration.

Test Matrix

Each test material shall be exposed to LHP or HPV for 4 hours. Depending on the results of the 4-hours decontamination runs other non-zero time points might be tested. There shall be three test coupons of each material. There shall also be one procedural blank for each material, which shall be placed into the decontamination chamber without any methamphetamine addition. For each test, three coupons of each material type shall be contaminated with methamphetamine (same as the test coupons), but not exposed to the fumigant. These shall be the time zero coupons, or positive controls. For each test there shall be a single laboratory blank that will not be exposed to methamphetamine and placed into shipping container before any handling of methamphetamine/methamphetamine spiked coupons. A preliminary test matrix is given in Table 1.

Sampling Procedures

Sampling shall be performed using methanol and Texwipe TX304 cotton wipes. Concentric Squares wiping technique shall be used for smooth and non-porous surfaces (metal, glass) and Side-to-side wiping (or blotting) technique shall be used for porous and semi-porous surfaces such as dry wall and vinyl tile coupons. Enough wipes and wipe media from the same lot shall be prepared to cover all required laboratory media blanks, test samples and quality control samples. The use of fresh latex or nitrile gloves for each separate test sample and blank is recommended. Vinyl gloves cannot be used for sampling due to the potential for leaching of phthalate plasticizers and contamination of the samples. If the sampled area remains substantially wet from the first wiping, the second wipe might be used in the dry state to soak up the residual solvent from the wipe. After the sampling, wipes shall be placed in the 50 mL polypropylene centrifuge tubes, labeled and sent to the subcontracting analytical laboratory for analysis. Wipes shall be refrigerated immediately after sampling and shipped for analysis in cooled containers (per NIOSH 9111 method methamphetamine and several related amines are stable on the recommended wipe media for at least 7 days at room temperature but refrigeration is recommended as soon as possible).

Table 1. Preliminary Test Matrix

Coupon Material	Treatment	Extent of Decontamination (hours)	Test Coupons (t≠0)	Positive Control (t=max)	Procedural Blank (t=max)	Lab Blank (t=max)	Total Coupons
Dry wall	pH-adjusted 15% H_2O_2	0*, 4	3	3	1	1	8
Vinyl tile	pH-adjusted 15% H_2O_2	0*, 4	3	3	1	1	8
Galvanized metal	pH-adjusted 15% H_2O_2	0*, 4	3	3	1	1	8
Glass	pH-adjusted 15% H_2O_2	0*, 4	3	3	1	1	8
Dry wall	Vaporized pH-adjusted 15% H_2O_2	0*,4	3	3	1	1	8
Vinyl tile	Vaporized pH-adjusted 15% H_2O_2	0*, 4	3	3	1	1	8
Galvanized metal	Vaporized pH-adjusted 15% H_2O_2	0*, 4	3	3	1	1	8
Glass	Vaporized pH-adjusted 15% H_2O_2	0*, 4	3	3	1	1	8

* *Positive control,*

Sample Identification

Each coupon shall be identified by a description of the building material and a unique sample number. The sampling team shall maintain an explicit laboratory log which shall include records of each unique sample number and its associated work assignment number, decontamination method, length of time treated, and the date treated. The sample code shall ease written identification of the coupons.

Sample Handling and Custody

Careful coordination with the EMSL Analytical, Inc. laboratory is required in order to arrange for successful transfer of uncompromised samples in a timely manner for all tests and analysis. To ensure the integrity of samples and to maintain a timely and traceable transfer of samples, an established and proven chain of custody or possession is mandatory. It is imperative

that accurate records be maintained whenever samples are inoculated, transferred, stored, analyzed, or destroyed. The primary objective of these procedures is to create an accurate written record that can be used to trace the possession of the sample from the moment of its creation through the reporting of the results. A sample is in custody if it is in any one of the following states:

- In actual physical possession
- In view, after being in physical possession
- In physical possession and locked up so that no one can tamper with it
- In a secured area, restricted except to authorized personnel
- In transit.

Laboratory-test team members shall receive copies of test plans prior to the test. Pre-study briefings shall then be held to apprise participants of the objectives, test protocols, and chain of custody procedures to be followed. These protocols must mesh with any protocols established by EPA. In the transfer of custody, each custodian or sampler shall sign, record, and date the transfer. Sample transfer shall be on a bulk basis (the preferred logistical scheme is to send batch from the fully completed test sequences as one shipment). Coupons shall be sent on a sample-by-sample basis only for repeated tests or in case of other unforeseen circumstances. A chain of custody record will accompany the samples. When turning over possession of samples, the transferor and recipient shall sign, date, and note the time on the record sheet. This record sheet allows transfer of custody of a group of samples from ARCADIS to EMSL Analytical, Inc. and from EMSL Analytical, Inc. to ARCADIS. The original custody sheet must accompany the shipment. The ARCADIS WA Leader shall retain a copy.

Analytical Testing of Methamphetamine Oxidized Byproducts

The next phase of research shall include identifying the oxidized and non-oxidized methamphetamine byproducts with the greatest environmental impact. The systematic pathway for degradation of methamphetamine can be explained in Figure 2.

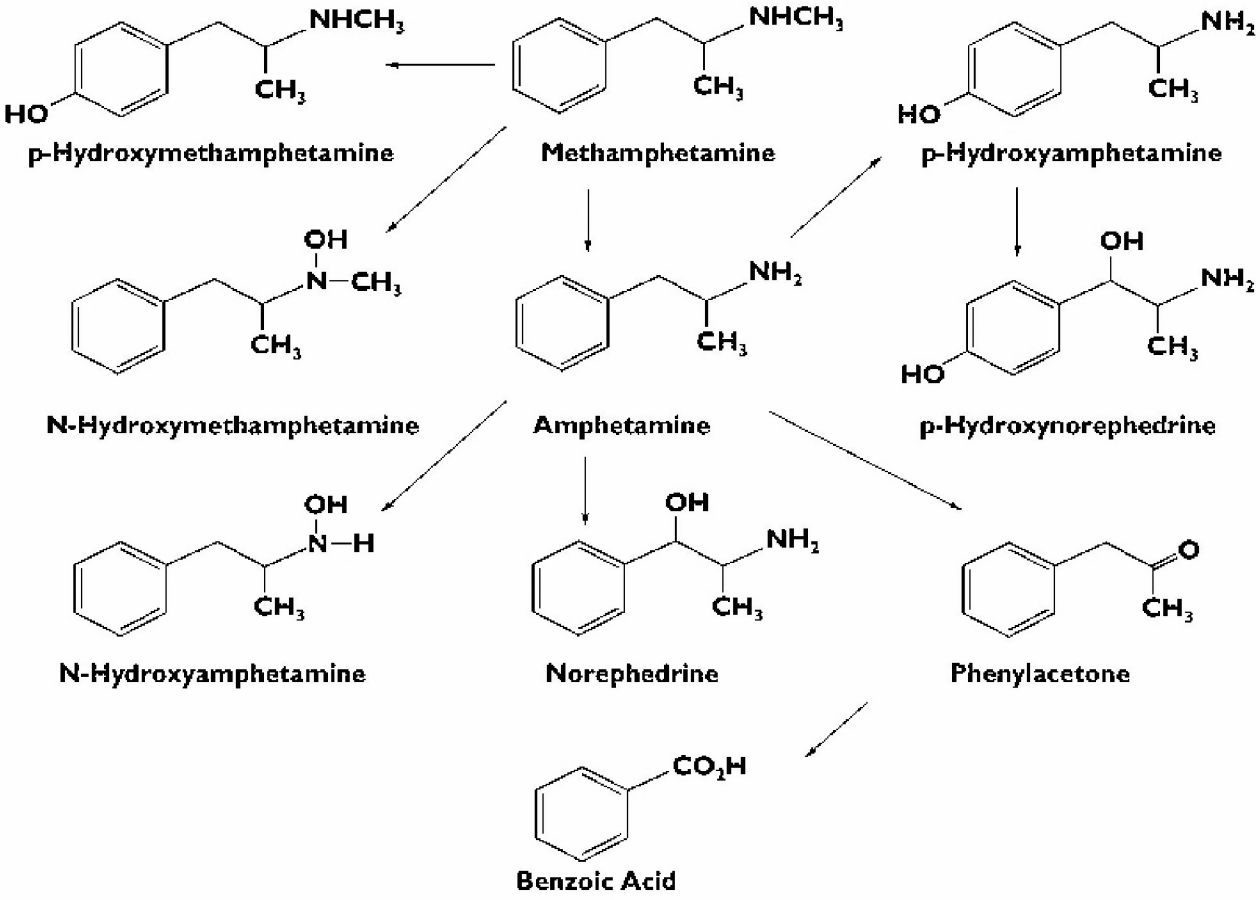

Figure 2. Proposed Pathway for Methamphetamine Degradation

Methamphetamine analyses shall be performed by EMSL Analytical, Inc., NJ, USA. (http://www.emsl.com/) using LC/MS. The test method is based on the NIOSH Method 9111. The extraction (desorption) method was modified by using 1% acetic acid in water as an extraction solvent (NIOSH 9111 uses dilute sulfuric acid which, according to EMSL Analytical, is too potentially corrosive to their instruments). Reporting limit was 10 ng per wipe. Laboratory QA measures were: 7 point calibration, internal standard spiked prior to extraction (per NIOSH 9111), duplicate injection every 10 samples, ICV (Initial Calibration Verification) at midpoint, LCS (Laboratory Control Sample)/LCSD (Laboratory Control Sample Duplicate) at midpoint concentration, EC (End Check). The identification shall be determined by comparing the chromatographic retention time and mass spectrum of the unknown to the corresponding parameters for the pure compound analyzed on the same instrument using identical methods. Matching retention times and mass spectra shall provide positive, confirmed identifications. All compounds of concern shall be identified and levels reported. If no high quality match is obtained, the unknown spectrum will be compared to spectra contained in the latest version of the

NIST mass spectral library. The trained analyst shall decide if the identification is likely based on the match quality and the reasonableness of the retention time. Compounds identified by this procedure shall be clearly indicated. If no highly probable match is obtained, the compound shall be labeled as an unknown.

The percentage of methamphetamine recovery shall be completed by dividing the amount recovered from each surface by the amount seeded, and multiplied by 100%. Theoretically, the recovery generated by an ideal method should be close to 100%. The quantification of methamphetamine shall be based on the integrated abundance from the EICP (extracted ion chromatographic profile) of the primary characteristic ion. Quantification shall take place using the internal standard technique and the following calculations;

Calculate final concentration, C, of analyte in µg/wipe:

$$\mathbf{C = c \times (V_1 / V_2) - b}$$

c = concentration in sample (in µg/sample determined from the calibration curve)
(V_1 / V_2) = dilution factor, if applicable **V_1** = 10 ml (Volume of desorbate taken for cleanup step/extracts) **V_2** = volume in ml of desorbate actually taken for cleanup and dilute to 10 ml with blank desorbing solution containing internal standard.
b = concentration in media blank (in µg/sample determined from the calibration curve)

Report concentration, **C'**, in µg per total area wiped (in cm^2) as follows:

$$\mathbf{C' = (C/A)}$$

C = µg/ sample
A = Total area wiped in cm^2 per sample

Calculation for relative response factor (RRF):

$$\mathrm{RRF} = \mathbf{(A_c \times C_{is})/ (A_{is} \times C_c)}$$

$\mathbf{A_c}$ = Area of the target analyte
$\mathbf{A_{is}}$ = Area of the corresponding internal standard
$\mathbf{C_{is}}$ = Concentration of the corresponding internal standard
$\mathbf{C_c}$ = Concentration of the target analyte

Calculation for percent relative standard deviation (%RSD):
Percent RSD = (standard deviation of RRFs / mean of RRFs) x 100

Calculation for determining concentration of methamphetamine:
Concentration of Methamphetamine = (area of methamphetamine in sample / area of I.S. in sample) x (concentration of I.S. / average RRF) x dilution factor

Calculation for percent recovery (%Recovery):
Percent Recovery = (amount of methamphetamine recovered / amount of methamphetamine spiked) x 100

IX. DELIVERABLE SCHEDULE

Deliverables include quarterly progress reports, and a technical report detailing the analyses performed and the results of such analyses. The technical report shall meet the needs discussed. The report shall be submitted no later than 30 days prior to the end of the award period.

The contractor shall prepare a quality assurance project plan (QAPP) for this QA Category III measurement project. After preparation, the QAPP shall be reviewed, approved, and signed by the ARCADIS QA officer. Once it has been signed, it shall be submitted to the EPA work assignment manager and the EPA quality manager for their review, approval, and signatures. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA QA staff. The technical report shall be submitted electronically in MS WORD and MS EXCEL format, as appropriate, with sufficient annotation as deemed adequate by the EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-36

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Identification and Development

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

[ ] Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LDE:

Work Assignment Manager Name: John Drake (Signature) (Date)	Branch/Mail Code: Phone Number: 513-235-4273 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name: (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 3-27-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Identification and Development of Standard Methods for Evaluation of the Performance of Sequestration Coatings WA 4-36

Background

Research increasingly indicates that if a CsCl (define acronym) dirty bomb is detonated, immediate action may be necessary to treat urban surfaces. Cs migration and chemical binding are rapid and after some period of time significant decontamination may not be feasible. Immediate treatment of surfaces (within hours) with a sequestrating compound that can be easily applied in large quantities could alleviate much difficulty in subsequent decontamination. In FY-09 performance specifications for such a coating were developed and promulgated as ASTM (define acronym) specification E-2731-09 Standard Specification for Materials to Mitigate the Spread of Radioactive Contamination after a Radiological Dispersion Event. A set of test methods needs to be identified and/or developed to verify that products meet the ASTM performance standard. ASTM E-2731-09 articulates eighteen different performance requirements such as tear strength, abrasion resistance, weatherability, shelf life, and so on. Coatings formulated to meet these requirements are anticipated to be in the class of polymers. Some test methods applicable to polymeric coatings are known to exist (such as tear strength) whereas others will need to be adapted based on similar performance requirements for surface coatings, or will need to be developed. In FY11 NHSRC began development and validation of two draft test methods for (1) weatherability, and (2) shelf life of sequestration coatings. In FY12-13 NHSRC completed development of the methods including performance of validation tests, formatted the methods according to ASTM format requirements, and produced a report documenting the method development work and validation testing. Following completion of this method development NHSRC exercised the methods by testing three commercially available coatings and produced a data report documenting the results. The purpose of this Work Assignment (WA) is to complete resolution of review comments to final deliverables from WA 3-36.

Tasks

Task 1.0- The Contractor shall address all comments from review of deliverables from WA 3-36, revise documents accordingly, and provide final documents.

Products

All products developed related to this SOW shall conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at http://wwwepa.gov/nhsrc under the policy and guidance tab.

Deliverables

Task Description	Task	Product	Date of Completion
Resolve review comments and revise documents	1	Final documents	31 Jul 2013

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-38

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Chamber Decontamination Studie

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Joe Wood (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-5029 FAX Number: 919-541-0496
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 3-27-13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK

Chamber Decontamination Studies Using Mock Office Setup

OMIS DCMD
APPCD ON-SITE CONTRACT EP-C-09-027

I. PERIOD OF PERFORMANCE

The period of performance for this work assignment (WA) shall be from April 1, 2013 to March 31, 2014.

II. SUMMARY OF OBJECTIVES

This work will involve evaluating the sporicidal efficacy of chlorine dioxide gas utilizing a mock office set up in the COnsequence ManageMent ANd Decontamination Evaluation Room (COMMANDER) chamber located in H130. Tests will be conducted utilizing bacterial spores (such as *Bacillus atropheus*, a surrogate for *Bacillus anthracis*) aerosolized into COMMANDER. A report shall be drafted of the methods and results.

III. BACKGROUND

Work will build upon (but not duplicate) tests conducted under WA 2-38 and 3-38.

IV. TECHNICAL APPROACH

In COMMANDER, decontamination efficacy will be determined based on inactivation of bacterial spores disseminated into the chamber. Lastly, this work assignment covers only the efforts related to conducting the decontamination tests. All microbiological preparation and analyses work will be conducted by the on-site Biolab under a separate work assignment on this same contract.

V. AFFORDABILITY

This effort is labor intensive, which is where the bulk of the funding is required. Normal expendable laboratory items are also required for this project.

VI. FACILITIES AND MATERIALS

All tasks described in this SOW shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr.

VII. TASKS

No work conducted under this WA shall duplicate work conducted under previous work assignments, unless directed by the WA manager (WAM), and in order to troubleshoot problems from previous work and to assess repeatability (precision) of the data gathered previously. All microbiological preparation and analyses work will be conducted by the on-site Biolab under a separate work assignment on this same contract.

The Contractor shall perform the following tasks:

1. Prepare an amendment(s) to the existing quality assurance/test plan (QATP), which shall cover the experiments as described in Task 2 of this SOW. The QATP amendment shall be in agreement with the requirements set forth in the Quality Assurance Requirement Form (QARF) and as delineated in "Attachment #1". To the extent feasible, the QATP shall be consistent with and based upon existing QATPs, developed under other similar work assignments from previous or current APPCD contracts.

2. Conduct up to 8 experiments in COMMANDER utilizing chlorine dioxide gas. Tests will determine the log reduction in viable bacterial spores aerosolized into COMMANDER using a mock office set up.

3. Provide general support for maintaining the lab equipment. This support shall include assembly, maintenance, troubleshooting, and configuration support for the any equipment used for testing. Support shall also include the purchase of any expendable materials, with prior approval from the WAM, for use in this project.

4. Report the results of all tests, including data received from the Biolab (work conducted under the Biolab WA, in support of this WA) to the WAM as soon as possible via email and through the use of the DTRL share drive. The WAM shall be notified immediately of any problems encountered in the laboratory or with the results obtained. These data shall include any generated data files (i.e., logged data) properly annotated, reports of the experimental conditions, calibration checks, measured variables, and a listing of the samples awaiting further analysis.

5. Analyze the data per the requirements in the QATP and in consultation with the WAM, and report the results of these analyses as soon as possible via email and through the use of the DTRL share drive. The expected data analyses would be in the form of Excel spreadsheets or other appropriate software.

6. Meet with the WAM at least every week to provide a project status update. The update shall include a synopsis of activities taking place the past week, problems encountered, and work planned for the next week.

7. Update the health and safety research protocols, as needed, as required by the EPA Facility and APPCD safety personnel. Updates to these protocols shall be approved by the EPA WAM and safety personnel prior to the commencement of any testing. The contractor shall provide a copy of the health and safety plan to the WAM and the ORD-Safety Office for discussion.

8. Prepare monthly reports to EPA that summarize work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges. The ODC charges shall be documented in the report in a way that the items purchased, vendor, and cost are clearly indicated.

VIII. DELIVERABLE SCHEDULE

The following table outlines the expected schedule that the contractor shall meet for the period covered by this SOW. The schedule assumes a start date of April 1, 2013. Dates dependent upon completion of specific tasks shall be updated based on discussions between the contractor WAL and EPA WAM during the development of the test plans to cover the work specified herein.

Suggested Deliverable Schedule

Deliverable	**Completion Date**
Submit work assignment plan	4/15/13
Submit first draft of test/QA Plan amendment	4/21/13
Revise test/QA Plan amendment per WAM comments	2 weeks after comments received
Complete Task 2	1/31/14
Complete other tasks	ongoing

IX. REPORTING REQUIREMENTS

- The Contractor shall prepare a brief memorandum to the WAM which discusses how well various measurements described in the QA plan were met.

- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.

- All data and analyses worksheets generated as discussed in Section VII. shall be provided in electronic format in Excel and/or other appropriate software, in consultation with the WAM.

X. QUALITY ASSURANCE

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The contractor shall prepare a QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-40

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014	Mobile Monitoring to Quantify
	Base Option Period Number 4	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Richard Baldauf (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4386 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name: (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 4-18-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Statement of Work WA 4-40

Mobile monitoring to quantify the impacts of roadway design on near-road air quality

1.0 Background:

Recent research by the EPA suggests that roadway design, including the presence of noise barriers and vegetation, may affect concentrations of traffic-generated pollutants away from the road. ORD researchers have conducted wind tunnel and field studies to evaluate these effects, as well as developed model algorithms to predict pollutant transport and dispersion under varying roadway design conditions. The goal of this project is to evaluate the performance of this model algorithm in predicting pollutant transport and dispersion, which requires conducting a field study and analyzing data collected on traffic emissions and pollutant dispersion.

2.0 Task and Method Overview

The contractor shall execute a one (1) month field monitoring study to measure particulate matter (PM), nitrogen dioxide (NO2), and carbon monoxide (CO) on and near a large highway at a location in the United States to be identified. This field study will be conducted over a continuous one month period during the summer or fall of 2013 at sites to be selected by the WA COR. In addition, the contractor shall conduct analyses of the data collected during this field study, as well as analyze data collected from previous field and vehicle emissions projects that are applicable to understanding traffic emissions and the role roadside features may play in affecting pollutant transport and dispersion.

This study will include the deployment of a mobile monitoring vehicle equipped with air monitoring and meteorology equipment. The all-electric vehicle shall be deployed to conduct real-time mapping of PM, N_2O, NO_2, and CO by repeatedly driving a specified route at the study site. A portion of the study site will also be further investigated using portable backpack and fixed-site sampling for combinations of these pollutants. The EPA SUV may be used for fixed-site sampling of PM, NO_2, and CO. The vehicles and portable sampling equipment are already on the ARCADIS contract and available for use in this study – the Geospatial Monitoring of Air Pollution (GMAP) electric car to support real-time air pollution mapping, the SUV for fixed site sampling with batteries, two backpack systems equipped with sampling inlets and measurement instruments, and portable box samplers equipped with sampling inlets, instruments, and temperature control features. EPA will also provide a trailer to transport the GMAP vehicle to and from the selected site, if deemed necessary by the WA COR.

In addition to analyzing data from the field study implemented under this work assignment, the contractor shall also analyze data from a field study conducted in Detroit, Michigan in 2012 investigating near road air quality and noise barrier effects.

3.0 Description of Tasks:

Task 1. Site Selection and Preparation:

The EPA WAM will provide a description of the project site location, most likely to be in Atlanta, Denver, or Sacramento areas. The contractor shall obtain any necessary permits and approvals for conducting the field study at the chosen location. The contractor shall visit the selected monitoring sites in coordination with EPA personnel as required for the purpose of evaluating field sampling deployments.

Task 2. Technical Support for the Backpack and Portable Samplers

The backpack sampling systems are specially customized to support mobile monitoring of air pollutant concentrations on foot. The portable fixed-site systems allow easily relocateable stationary sampling. These systems utilize hand-held monitoring equipment and GPS capabilities into an integrated system capable of mapping spatial distributions of pollutant concentrations. Contractor support shall provide general backpack, portable fixed-site, and equipment support and transportation/shipment to the field sites. The contractor shall update and implement the standard operating procedures (SOP) for field deployment involving these systems. The SOPs include equipment descriptions and operations, backpack setup and maintenance, instrument calibration and maintenance, data storage, and data retrieval. The contractor shall also provide support in converting raw data files from the backpack sampling instruments into Excel spreadsheets. The contractor shall also support the development of the Quality Assurance Project Plans (QAPPs) based from previously approved QAPPs for similar studies.

Deliverable 2.1: Contractor shall submit an updated SOP for the use of the backpack sampling systems to the EPA WA COR for use in the project QAPP prior to initiating field measurements.

Task 3. Technical and Safety Support for the Electric Vehicle and SUV

The GMAP vehicle is an electric vehicle specially customized to support onboard sampling. Given its limited driving range and specialized design, contractor support shall provide general vehicle support and vehicle transportation to field sites. The contractor shall update and implement the safety plan for field deployment activities involving the GMAP and SUV vehicles. The safety plan was developed for previous studies, and includes emergency response protocols in the event that the GMAP vehicle loses power while driving on a highway or arterial road. In addition, a multi-year technical support agreement is in place to ensure that the vehicle manufacturer will provide on-site troubleshooting in the event of significant vehicle performance issues during a field campaign.

Deliverable 3.1: Contractor shall submit an updated GMAP vehicle and SUV safety plan for the field study to the EPA WA COR prior to initiating field measurements and provide general vehicle support.

Deliverable 3.2: Contractor shall provide a signed agreement for technical support from the GMAP vehicle manufacturer through at least three months after the proposed completion date for this project in the contractor's project workplan, to be completed prior to initiating field measurements. This agreement shall include in-person support during domestic deployments.

Task 4. Development of a project Quality Assurance Project Plan (QAPP)

The contractor shall synthesize and prepare all information necessary to submit and obtain approval for a Quality Assurance Project Plan (QAPP) for the field study described in this SOW. The QAPP shall encompass, but not be limited to, all field measurements, sample handling, reporting, and data analysis procedures required to successfully implement the field study for the GMAP, SUV, backpack and other monitoring devices employed. This QAPP will likely be a Category III document based on previous studies. The QAPP shall be accompanied by a signature page that is signed by the ARCADIS work assignment leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the ARCADIS work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA Quality Assurance Staff.

Deliverable 4.1: Contractor shall submit a draft QAPP for the field study to the EPA WA COR prior to initiating field measurements and provide general vehicle support. The contractor shall also provide any updates and edits required to obtain final approval of the QAPP.

Task 5. Mobile Monitoring Instrumentation Support

The contractor shall conduct mobile monitoring instrumentation support activities prior to deployment to the field, including measurement inter-comparison tests, instrument calibration and maintenance, and development work to improve measurement accuracy. These work activities include, but are not limited to, inter-comparison activities of black carbon instrumentation, NO_2 using a Cavity Attenuated Phase Shift (CAPS) sampler, and N_2O measurement using a quantum cascade laser. The contractor shall conduct a one-week inter-comparison of monitoring instrumentation sampling while on-board a mobile monitoring vehicle in motion.

Deliverable 5.1: The contractor shall provide raw timestamped inter-comparison data to the EPA WA COR, within one week of sampling completion.

Deliverable 5.2: The contractor shall provide quantum cascade laser data (CO, N_2O) and CAPS data (NO_2), including any necessary post-processing, to the EPA WA COR within two months of inter-comparison sampling completion.

Task 6. Field Measurements:

The contractor shall execute a four-week field monitoring study in the continental United States, at a site to be chosen under Task 1 activities, to measure particulate matter, nitrogen dioxide, and carbon monoxide nearby a major roadway under various configurations (focus on noise barrier and clearing along the same road segment). Field sampling shall be conducted for approximately 4 hours each day, overlapping the morning commute period. In addition to the monitoring period, transportation, set-up, break-down, and data storage are estimated to take approximately 4 hours per sampling day. The field sampling configurations and quality assurance requirements are described in an approved Category III QAPP which will be completed under Task 4. In the event that inclement weather or other unavoidable circumstances prevent field sampling, a sampling day may be cancelled and rescheduled to meet the target of 24 sampling days for the study.

Each sampling day, the contractor will be responsible for transporting all vehicles and equipment to and from the site. The contractor will identify an appropriate site for vehicle and equipment storage and re-charging within a 20-mile radius of the project site. The contractor shall prepare for and conduct measurements of PM and CO onboard the electric monitoring vehicle and PM from the backpack and fixed site sampling systems. In addition to the collection of air monitoring data, the contractor shall also prepare for and collect local meteorology measurements throughout each sampling period and document roadway properties. The contractor shall also collect video of highway and any adjacent road activities for the electric vehicle during mobile data collection. The field sampling campaign will be manned with personnel with sufficient expertise to ensure a minimum 80% completeness Data Quality Objective, as described in the QAPP.

Deliverable 6.1: The contractor shall provide raw timestamped concentration and meteorology data to the EPA WA COR (e.g. upload to a shared file folder or e-mailed to the EPA WA COR) within 3 days of data collection. The data to be reported and formatting will be described in the QAPP.

Deliverable 6.2: The contractor shall provide a complete data package (DP) for the study within 4 weeks of field monitoring completion. The DP shall include field notes, quality-assured field data, in-field quality indicators, calibration checks (to be outlined in the QAPP), and video. No contractor-generated report will be required as a deliverable.

Task 7. Data Analysis:

The contractor shall conduct analyses of the data collected under Task 6, as well as data collected under previous EPA work assignments. For the data collected under Task 6, the contractor shall perform basic temporal and spatial statistical analyses to evaluate the compare the impact of a noise barrier on near-road air quality, and assess the spatial variability of near-road pollutant concentrations. These data analyses will include spatial comparisons, regressions, and data mapping using software programs such as MATLAB, Excel, or R-software.

The contractor shall perform similar statistical analyses of field data previously collected by ARCADIS for the EPA under WA3-40 in Detroit, Michigan. This data included GMAP and backpack sampling simultaneously and at multiple locations. The contractor shall also perform similar statistical analyses of field data previously collected by ARCADIS for the EPA under WA2-12 in Research Triangle Park, North Carolina. This data included size distribution and PM filter data from brake and tire wear on the GMAP vehicle while in motion. This data will be useful to determine the emission rates, size distributions, and morphology of brake/tire emissions from the GMAP vehicle to determine the potential influence for self-contamination during on-road sampling. In addition, this data will be useful in determining how roadside features may affect the transport and dispersion of brake and tire wear emissions in the near-road environment. The EPA WA COR will provide any data not already in the possession of the contractor to support this Task.

Deliverable 7.1: The contractor shall provide a draft report (in Word format) and supporting data (in Excel format) analyzing results of the measurements collected in Task 6 of this SOW, as well as any applicable quality assurance measurements collected in support of this project.

Deliverable 7.2: The contractor shall provide a draft report (in Word format) and supporting data (in Excel format) analyzing results of the measurements collected under ARCADIS WA2-40 in Detroit, Michigan, as well as any applicable quality assurance measurements collected in support of this project.

Deliverable 7.3: The contractor shall provide a draft report (in Word format) and supporting data (in Excel format) analyzing results of the measurements collected under ARCADIS WA2-12 in RTP, NC, as well as any applicable quality assurance measurements collected in support of this project.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-42

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Characterization and Control o

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Chun-Wai Lee	Branch/Mail Code:
(Signature) (Date)	Phone Number: 919-541-7663
	FAX Number:
Project Officer Name: Kevin Sudderth	Branch/Mail Code:
(Signature) (Date)	Phone Number: 919-541-3670
	FAX Number:
Other Agency Official Name	Branch/Mail Code:
(Signature) (Date)	Phone Number:
	FAX Number:
Contracting Official Name: William Yates	Branch/Mail Code:
(Signature) 4-18-13 (Date)	Phone Number: 513-487-2055
	FAX Number:

Statement of Work
For WA 4-42 (FY 2013)

Characterization and Control of Emissions from Oxy-Coal Combustion

Project Description:

Oxygen enrich coal (oxy-coal) combustion as applied to utility coal boilers essentially involves process modifications to remove ~80% of volumetric input flow (nitrogen) so as to produce a concentrated CO_2/H_2O exhaust amenable to further processing, compression, and sequestration. The same pollutant species such as sulfur, fuel nitrogen, ash, metals, Hg, potential organic hazardous air pollutants (HAPs), etc. are present in the coal as in air firing, however, there is very little information on how these species will behave and be transformed under the unique conditions of oxy-coal combustion and also the effects of this unique environment on the performance of existing pollution control devices. These transforming pollutant species are likely to affect the operation of different boiler and pollution control systems in both adverse and perhaps beneficial ways. Further, emissions that would normally escape controls and be released as air emissions (O_2, SO_2, SO_3, NO, NO_2, ultrafine ash and metals, Hg, Se, and organic HAPs) now may be compressed and sequestered with the CO_2 and affect its chemistry during transport and in geological storage. In this project, the effect of oxy-coal combustion on the formation and behavior of these pollutants and the effect of this environment on the performance of existing pollution control devices will be investigated.

In addition to many technical challenges in the oxy-coal combustion process, there is also a significant lack of understanding regarding the environmental issues associated with the CO_2 compression process following the combustion. Key questions include: (1) what flue gas components, compositions, and concentrations can be processed by compression and purification units (CPUs) and what additional pretreatment is required; (2) how do flue gas species partition to the various CPU effluents; (3) how do process changes on the combustion side affect CPU operation and partitioning; (4) what purity of CO_2 produced from the CPU is required to ensure safe, very long-term, geologic sequestration; and (5) is it possible for trace levels of impurities (such as oxygen, nitrogen, argon, acids, particles, metals, CO, organics, etc.) to be compressed and sequestered with the CO_2? Air Liquide, a leading industrial gas provider, has developed a compression and purification technology concept to capture, compress, and purify CO_2 generated from the oxy-coal combustion process for sequestration purposes. The process is designed to process the CO_2-enriched flue gas generated from the oxy-coal combustion process through compressing and condensing CO_2 to separate it from other condensable and non-condensable flue gas components for pipeline transportation and geologic sequestration. The multi-stage compression and purification unit (CPU) process has a high potential to separate and concentrate pollutants and impurities from the flue gas. In contrast to existing conventional coal-fired power plants, this process has the potential to produce near zero emissions of air pollutants. APPCD and Air Liquide are collaborating on their experimental research efforts for evaluating the potential of CPU technologies to reduce pollutants from oxy-coal combustion under a Cooperative Research and Development Agreement with EPA (CRADA). The objectives of research are: to examine different flue gas conditioning and CPU configurations options, and how these affect partitioning, emissions, and potential CO_2 purity and; to validate the efficiency of various CPU process

parameters to partition and remove pollutant species (SOx, NOx, Hg, PM, H_2O, CO, organic VOCs, etc.

Tests shall be conducted on APPCD's two existing combustion research facilities, the drop tube furnace and the Innovative Furnace Reactor (IFR). The drop tube furnace is a bench-scale system designed to study coal combustion under a well controlled environment. The pilot scale, refractory-lined, down-fired furnace (150,000 Btu/hr nominal firing rate) which has been used to simulate and generate a coal combustion environment and flue gas cooling conditions similar to those of coal-fired utility boilers. The IFR is equipped with a fabric filter (FF) and an electrostatic precipitator (ESP) for particulate matter (PM) control. Tests will be performed on this facility to evaluate the emissions and control from oxy-coal combustion. The IFR has been modified for firing natural gas and coal under simulated O_2 and CO_2 enrich conditions similar to those of oxy-natural gas and oxy-coal firing boilers currently under development by the industry. Recirculation of flue gas in the modified IFR's flue gas ductwork, is proposed in the testing of this WA. A laboratory scale CO_2 CPU unit which is compatible with the IFR combustion research facility will be designed and installed in cooperation with Air Liquide.

Objective:

The primary objective of this project is to investigate the transformation of air pollutants under simulated oxy-coal and oxy-natural gas firing conditions. The effects of this unique combustion environment on the performance of existing air pollution control devices such as FF and ESP, wet scrubber, and SCR, will be evaluated. The potential of the CPU technology to reduce pollutants produced under oxy-coal and oxy-natural gas combustion conditions will also be assessed.

Approach:

The IFR shall be operated on natural gas initially for combustion tests to be performed under flue gas recirculation without PM control for simulating firing conditions similar to those of the oxy-coal firing boilers currently under development. The objective shall be to achieve greater than 80% CO_2 concentration in the flue gas measured at the outlet of the furnace. Coal combustion flue gases have much significantly higher SO_2 concentration and low moisture content than those of natural gas combustion flue gases. The high moisture content in the re-circulated natural gas combustion flue gas generated by the IFR shall be reduced substantially by passing the flue gas through a moisture condenser followed by an electric re-heater. The reheated flue gas shall be doped with SO_2 gas supplied from a gas cylinder for simulating the high SO_2 content of a re-circulated coal combustion flue gas.

The coals tested in the project shall be identified and selected from commercial suppliers. Initial effort of the tests shall be focused on those coals which have been tested by major oxy-coal combustion organizations from academia and industry.

Statement of Work:

TASK 1. Work Plan, Reporting, Budget, And WA Management

The contractor shall prepare and deliver to the WA manager (WAM) a work plan and budget within 20 days of WA effective date. The work plan shall include a description of how the

contractor shall accomplish each task, along with a breakdown, per task, level of effort by professional level, a cost breakdown, and any underlying assumptions used. The contractor shall conduct activities necessary to manage the WA, including at least weekly communication with the EPA WAM. When responding to this WA, the contractor shall assume the primary responsibility to operate the IFR. The contractor shall update the existing Quality Assurance Project Plan (QAPP) under the direction of the WAM as specified in Attachment #1. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA Quality Assurance Staff. The contractor shall comply with all requirements as delineated on the "Quality Assurance Review Form" included with this WA.

TASK 2 Drop Tube Furnace Experiments

Experimental studies shall collect and analyze gas and particle emissions as a function of oxy-coal operating parameters (O_2, CO_2, H_2O, and temperature). The contractor shall modify, maintain, operate, and make improvements to the existing drop tube furnace and provide all necessary hardware. The furnace shall include any instrumentation required to maintain safe and continuous operating conditions. A fuel and oxidant feed system as well as safety and control systems are also included. Operate the drop tube furnace according to design specifications and establish operating conditions for producing coal combustion aerosol. Characterize the physical and chemical characteristics of drop tube furnace emissions during combustion of pulverized coal. This characterization shall provide data that shall be used to set operating parameters, such as fuel and oxygen feed rates and corresponding exhaust gas characteristics. Quantities to be measured include air and coal feed rates, outlet gas temperature, particle size distribution, and mass emission rates, particle compositions, O_2, CO, NO_x, SO_2, H_2O, and CO_2 gas concentrations. The contractor provide support and expertise for sampling and characterization of inorganic and carbonaceous particulate matter emissions. The contractor shall deliver raw analytical data (computer files and data sheets) and reduced data in the form of Excel spreadsheets, pie charts, and graphs of the data collected for each experimental study.

TASK 3. IFR Experiments

Operation of the IFR

An existing QAPP shall be updated by the contractor for this particular Task. The contractor shall not begin data collection until the QAPP is approved by EPA Quality Assurance Staff. The contractor shall assist in the operation of the IFR. This shall include but not be limited to: natural gas, pulverizing coal, operating the IFR under air- and oxygen-firing modes including the associated air pollution equipment, removing ash and scrubber residue from the facility, and operation of the flue gas sampling system.

Flue Gas Sampling and Analysis

The contractor shall provide support and expertise in vapor-phase sampling for flue gas. This shall include, but not be limited to CO_2, CO, O_2, SO_2, NO_x and total hydrocarbon (THC) measurements taken with continuous emission monitors (CEMs). The contractor shall also provide support and expertise on sampling and characterization of other pollutants which shall be included but not limited to fly ash and metals, Hg, Se, As, and organic HAPs.

Effect of oxygen enriched combustion on VOC emissions and PM emissions

The contractor shall operate the IFR under both oxy-natural gas and oxy-coal firing modes for evaluating the effect of oxygen enriched combustion on emissions of volatile organic compounds

(VOCs) and particulate matter (PM). The objective of this sub-task is to characterize VOC emissions and PM emissions from both oxy-natural gas combustion and oxy-coal combustion under different IFR furnace operating conditions. The contractor shall provide support and expertise for sampling VOC emissions using the SUMMA canisters. The VOCs samples contained in the canisters will be analyzed using gas chromatography coupled with mass spectrometry (GC/MS) by the existing organic lab set up in the Emissions Characterization & Prevention Branch (ECPB) for measuring VOC emissions from different combustion sources. The contractor shall also provide support and expertise on sampling and characterization of other pollutants such as organic HAPs.

The contractor shall provide support and expertise for sampling and characterizing PM emissions using both advanced continuous emission monitoring (CEM) techniques as well as conventional PM sampling techniques for subsequent PM composition analysis. The advanced CEM techniques shall be used include, but not limited to, Tapered-Element Oscillating Microbalance (TEOM) and laser light scattering censor. The PM samples shall be collected following EPA Method 5 which shall be characterized both organic and inorganic components of the sample. The organic component of the samples shall be analyzed using advanced optical techniques for characterizing the elemental carbon and organic carbon (EC/OC) of the samples. Advanced X-ray techniques shall be used to characterize the metals contained in the inorganic component of the PM samples.

Maintenance and Repair of IFR Facility

The contractor shall provide the labor necessary to maintain and repair the IFR including the CPU with associated air pollution equipment and other auxiliary equipment. Examples include repairing glassware, calibrating nozzles, pitot tubes, dry gas meters (DGMs), tracking equipment inventories, etc. Conduct of specific actions will be approved in writing by the WAM prior to initiation of any identified support action.

Purchasing of Expendable Supplies

The contractor shall be responsible for purchasing general expendable supplies required to maintain operation of the IFR including the CPU. The WAM shall provide approval for any purchases related to the supplies listed below.

These supplies shall include, but not be limited to:

a) Calibration, supply and carrier gases for analytical systems
b) Valves, tubing and piping
c) Compression fittings
d) Coal and transportation of the coal to EPA's RTP, NC facility
e) Chemicals and reagents including hydrated lime for the wet scrubber
g) Sorbent tubes and other gas-sampling consumables

TASK 4. CPU Development and Testing

The contractor shall provide technical support to APPCD in the collaborative CPU research with Air Liquide. Designing and installing a laboratory scale CO_2 CPU unit which is compatible with the IFR combustion research facility that will be used for conducting experiments to evaluate pollutant and purification process effects in oxy-coal combustion systems are the focuses of the collaboration. The contractor shall provide technical support to APPCD for assisting Air Liquide

to design and install a laboratory scale CO_2 CPU. The contractor shall coordinate through the WAM with Air Liquide for addressing technical issues associated with the compatibility of the CPU design and the IFR facility.

The contractor shall maintain strict control of all Confidential Business Information (CBI) provided by Air Liquide through the WAM for this task as it is required by Contract (EP-C-09-027) on handling of CBI by the contractor.

Reports of Work:

The contractor shall prepare a work plan and budget within 20 days of WA effective date. The contractor shall prepare and submit monthly reports in accordance with the terms and conditions of the contract.

The contractor shall prepare, as requested by WAM, data summary, project progress reports, briefing materials, presentation for technical meetings/conferences, and paper submitting to peer reviewed journals. The contractor shall coordinate with the WAM to ensure compliance with NRMRL/APPCD policies and guidelines concerning review and approval of technical papers and reports. Technical papers and presentations shall be co-authored with EPA researchers.

The contractor shall maintain at least weekly communications with the WAM. Additionally the contractor shall inform the PO and the WAM in writing when 75% of the total funds and/or hours contained in the work plan are expended.

Quality Assurance/Quality Control:

The contractor shall update the Quality Assurance Project Plan (QAPP) as required in Attachment #1 to the Statement of work for "Characterization and Control of Emissions from Oxy-Coal Combustion." After revision, the QAPP shall be reviewed and approved by the ARCADIS work assignment leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the ARCADIS work assignment leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the ARCADIS work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Any work involving environmental data shall not commence until the QAPP has received official approval from the EPA QA staff.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-45

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	OAQPS Metrology QA Laboratory

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
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4										
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Scott Moore (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-5104 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature)	3-27-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

SOW FY 2013-2014
Period of Performance: 04/01/2013 – 03/31/2014
Work Assignment Manager (WAM): Scott A. Moore
Work Assignment Title: OAQPS Metrology QA Laboratory Support
Contract Number: EP-C-09-027
Work Assignment Number: 4-45

Introduction

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To insure adequate QA it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to ensure that it produces reliable data. The Office of Air Quality Planning and Standards (OAQPS) require that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (MetLab) provides QA assistance to OAQPS researchers by providing the procedures and the standards to calibrate various scientific devices.

I. Goal/Purpose

The objective of this Work Assignment (WA) is to provide MetLab support to OAQPS. The MetLab is a facility with the capabilities to check (or audit) the calibration of Environmental Protection Agency (EPA) measurement instrumentation. A second objective is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to ensure and document that operations performed in EPA facilities produce data of known and adequate quality. This work assignment does not pertain to the calibration of facility devices such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons because these are not used to produce data for EPA research products.

II. Background Information

Data Uses — Primary users of the products of this WA will be researchers and operators of equipment in EPA facilities. Calibration and PEA results can be reported in research reports to support or verify findings.

Lab Site — The MetLab is located in rooms D360-A, D362, and D364-A in EPA's Research Center in Research Triangle Park, NC.

Experience — Personnel assigned to this WA must be capable of performing the tasks listed in Section III (Tasks), which include electrical work, plumbing, general experience with laboratory equipment and materials, a familiarity with the calibration of measurement devices, and a fundamental understanding of the principals behind the measurements and the ability to reduce data and report it according to the International

Organization for Standardization ISO 17025 "General Requirements for the Competence of Calibration and Testing Laboratories" (ISO 17025) and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

III. Tasks

Task 1. Metrology Quality Assurance Laboratory Support for OAQPS Ambient Air Standards Certification

The contractor shall calibrate the following devices that are used as Performance Evaluation Procedure (PEP) verification/calibration equipment:
30 BGI DeltaCal
23 BGI TriCal devices
23 BGI High Volume Calibrators
10 BGI tetraCal devices
1 druck device
1 temperature probe readout
86 Flow devices
87 Pressure devices
105 Temperature devices

Separate temperature, pressure, and flow calibrations shall include documentation that shows traceability to the National Institute of Standards and Technology (NIST).

The Contractor shall give monthly reports on all charges associated with Task 1

Calibrations confirm the manufacturers claim for accuracy and repeatability and must be accomplished on an annual basis. The equipment will be delivered to the Metrology Laboratory, Building D, Room D362, of the Main Campus of the EPA in RTP by the Contact Person (this may be an EPA PI, an EPA WAM of another project or a technician in charge of the equipment listed above). The devices will arrive in batches, historically it has been three batches; for each batch events will occur in the following order:

Event

1 The MetLab will be notified of the number of standards expect to ship and of the delivery date by the Contact Person.
2 The Contact person will deliver the BGI DeltaCal and/or BGI TriCal and/or High Volume devices to the MetLab in RTP and fill out a Work Request Form.
3 The MetLab will perform the PEP verification/calibration that applies to each of the devices and provide the temperature, pressure, and flow calibration's documentation that shows traceability to the NIST.
4 The MetLab will notify the Contact person when the calibrations are completed and the Contact Person pick up the devices from the MetLab in the RTP.
5 All of the BGI DeltaCal, the BGI TriCal and High Volume devices will be completed after three rounds (one batch at a time) have been completed.

IV. Deliverables (Applies to all Tasks)

The Contractor shall provide the following reports:

(1) Monthly reports of the laboratory support activities including the following:
   a) The number of and type of calibrations performed.
   b) Any costs incurred during calibration activities.
   c) Any maintenance activities performed.
   d) Any documentation activities performed.
   e) Any other activities that would impact the operation of the MetLab.

(2) Special reports as requested via a Technical Directive by the WAM. The Contractor shall give monthly reports on all charges associated with Task 1,

(3) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WAM shall be notified and then provide technical direction to the contractor for prioritization.

(4) The WAM shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WAM.

(5) The contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(6) Formatting of reports should be comparable to historical reporting and electronic files should be compatible with Agency Standard Software, such as MS Excel 2007, MS Word 2007 and Adobe Reader 9.0 or current agency standard software. Hard copies of reports are acceptable; however, electronic copies are encouraged.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-46

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	ITFB Metrology QA Laboratory S

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2): ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Scott Moore (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-5104 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 3-27-13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

SOW FY 2013-2014
Period of Performance: 04/01/2013 – 03/31/2014
Work Assignment Manager (WAM): Scott A. Moore
Work Assignment Title: ITFB Metrology QA Laboratory Support
Contract Number: EP-C-09-027
Work Assignment Number: 4-46

Introduction

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To insure adequate QA it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to assure that it produces reliable data. The Inhalation Toxicology Facilities Branch (ITFB), a part of the National Health and Environmental Effects Research Laboratory (NHEERL), requires that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (MetLab) provides QA assistance to ITFB researchers by providing the procedures and the standards to calibrate various scientific devices.

I. Goal/Purpose

The objective of this Work Assignment (WA) is to provide MetLab support to ITFB. The MetLab is a facility with the capabilities to check (or audit) the calibration of Environmental Protection Agency (EPA) measurement instrumentation. A second capability is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to ensure and document that operations performed in EPA facilities produce data will be of a known and adequate quality. This work assignment does not pertain to the calibration of facility devices such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons because these are not used to produce data for EPA research products.

II. Background Information

Data Uses — Primary users of the products of this WA will be researchers and operators of equipment in EPA facilities. Calibration and PEA results can be reported in research reports to support or verify findings.

Lab Site — The MetLab is located in rooms D360-A, D362, and D364-A in EPA's Research Center in Research Triangle Park, NC.

Experience — Personnel assigned to this WA must be capable of performing the tasks listed in Section III (Tasks), which include electrical work, plumbing, general experience with laboratory equipment and materials, a familiarity with the calibration of measurement devices, and a fundamental understanding of the principals behind the

measurements and the ability to reduce data and report it according to the International Organization for Standardization ISO 17025 "General Requirements for the Competence of Calibration and Testing Laboratories" (ISO 17025) and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

III. Tasks: : ITFB Metrology QA Laboratory Support

Task I. Met Lab Equipment and Supplies

(1) The Contractor shall obtain performance specifications on potential calibration equipment. The Contractor shall maintain and upgrade calibration systems and equipment as needed. Final decisions regarding upgrading and replacing equipment will be relayed to the Contractor in a technical directive through the WAM.

(2) The Contractor shall maintain MetLab equipment in proper working order. The Contractor shall identify calibration needs and ensure that the necessary factory equipment calibrations for the MetLab equipment are kept up to date. The Contractor shall maintain a record of all maintenance activities. Whenever practically possible the calibration data for this equipment shall include National Institute of Standards and Technology (NIST) traceable information.

(3) The Contractor shall give monthly reports on all charges associated with all Tasks.

Task II. ITFB Calibrations

(1) The Contractor shall perform measurement device and equipment calibrations that conform to ISO 17025 and the GUM. The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WAM shall be notified and then provide technical direction to the contractor for prioritization. The Contractor shall maintain a record and data base of all equipment calibrations and calibration schedules.

(2) The Contractor shall perform equipment calibrations to the following list of devises:

a) 37 Flow devices
b) 11 Relative Humidity Probes
c) 3 Pressure devices
d) 4 Ozone Analyzers
e) Any other devise as needed

(3) The Contractor shall develop, document, and implement detailed calibration operating procedures for all laboratory calibration services.

(4) The Contractor shall assemble and maintain a system of published procedures and product information relevant to calibration measurement procedures and measurement devices.

(5) The Contractor shall develop a Standard Operating Procedure (SOP) for scheduling calibration of EPA equipment. This SOP will include identifying whether the device is in use and informing the Facility Manager, Principle Investigator (PI) or the Technical Lead of the project using the device of the need for calibration.

(6) The Contractor shall give monthly reports on all charges associated with all Tasks.

Task III. Validation of Procedures and Calibration Tracking System

The Contractor shall confirm the current acceptable validation methods for all calibration systems used in the MetLab and also for the calibration tracking system. Any confirmation of validation methods should be documented. All database functions that are user-programmed shall be tested and the validation documented. Each revision to the database software (exclusive of the data in the database) shall have an identifiable revision number assigned to it. The Contractor shall give monthly reports on all charges associated with Sub-Tasks.

IV. Deliverables (Applies to all Tasks)

The Contractor shall provide the following reports:

(1) Monthly reports of the laboratory support activities including the following:
   a) The number of and type of calibrations performed.
   b) Any costs incurred during calibration activities.
   c) Any maintenance activities performed.
   d) Any documentation activities performed.
   e) Any other activities that would impact the operation of the MetLab.

(2) Special reports as requested via a Technical Directive by the WAM. The Contractor shall give monthly reports on all charges associated with all Tasks.

(3) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WAM shall be notified and then provide technical direction to the contractor for prioritization.

(4) The WAM shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WAM.

(5) The contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(6) Formatting of reports should be comparable to historical reporting and electronic files should be compatible with Agency Standard Software, such as MS Excel 2007, MS Word 2007 and Adobe Reader 9.0. Hard copies of reports are acceptable; however, electronic copies are encouraged.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-48

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Cook Stoves Performance and Em

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Jim Jetter (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-4830 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 3-27-13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Statement of Work

WA 4-48: Cook Stoves Performance and Emissions Testing

OBJECTIVES

The primary purpose of this WA (work assignment) is to continue work performed under WA 3-48 to measure performance and air pollutant emissions from practical, fuel-efficient, "clean-burning" cook stoves. Pollutant emissions from "clean-burning" stoves shall be compared to emissions from the traditional "three-stone" fire.

A second purpose of this study is to provide stove emissions information that will be valuable to Global Alliance for Clean Cookstoves (the Alliance) partners disseminating stove technology in the field.

A third purpose of this study is to determine how cook stove performance and emissions are affected by conditions including fuel moisture content, fuel size and shape, operator technique, weather conditions, pot size and shape, and stove durability.

BACKGROUND

This work is part of EPA's commitment in support of the Global Alliance for Clean Cookstoves. The Alliance was launched after ten years of foundational work conducted by the EPA-led Partnership for Clean Indoor Air (now integrated with the Alliance). The Alliance is a public-private partnership that seeks to save lives, improve livelihoods, empower women, and protect the environment by creating a thriving global market for clean and efficient household cooking solutions. Its ambitious goal is to foster the adoption of clean cookstoves and fuels in 100 million households by 2020. For more information, see the Alliance web site at: http://www.cleancookstoves.org/

Air pollutant emissions from solid-fuel cookstoves are estimated to cause 4 million premature deaths annually – greater than the combined impact of HIV, malaria, and tuberculosis in developing countries. Cookstove emissions of black carbon, brown carbon, organic carbon, CO_2, and methane also affect global climate change.

Reducing problems associated with burning solid fuel indoors provides multiple benefits. Human health is improved through better indoor air quality and ambient air quality. Sustainability and ecology are promoted through reduced deforestation and protection of biodiversity. Global climate change is addressed through reduced emissions of greenhouse gases and other climate forcers. International relations are improved through collaboration with partners.

TEST PLAN

Continuation of support for data analysis:

The contractor shall continue to provide support for processing and analyzing data from the last round of cook stove tests conducted under WA 3-48. The contractor shall work closely with the EPA WAM. The contractor shall use DASYLab software for data acquisition and Microsoft Excel spreadsheets for processing data.

Operation of facilities:

The contractor has completed a new cook stove test facility in the EPA High Bay Building (Room H-106) under WA 2-48. This new system is similar to the one previously used for testing cook stoves under WA 2-48, except the new system adds capability for testing stoves with tall chimneys. Figures 1-3 show three modes of operation for the new system. The contractor shall operate, maintain, and repair the facilities, as needed. EPA will provide instrumentation.

Stoves to be tested:

The EPA WAM will obtain the stoves and will specify which stoves will be tested. The Contractor shall operate the stoves during the testing. Stoves to be tested will include the following types:

- Liquid- and gas-fueled stoves
- TLUD (top-lit up-draft) stoves
- Built-in-place plancha stoves
- Charcoal stoves
- Fan stoves
- Rocket stoves
- Institutional stoves
- Other biomass stoves

Total number of stove/fuel combinations to be tested: 40

Fuels to be tested:

Wood-burning stoves shall be tested with high- and low-moisture hardwood, red oak, fuel. Freshly cut "green" red oak firewood without bark, lengths approximately 14", will be obtained from a local vendor. The wood shall be cut on a table saw and/or band saw to produce sticks that shall be approximately 2 cm x 2 cm in cross section. Half of the fuel wood shall be air dried to a moisture content of approximately 10 percent (on a wet basis), and the other half of the fuel wood shall be stored in air-tight barrels in a freezer to keep the moisture content at approximately 30 percent.

The charcoal stoves shall be tested with "lump" charcoal (not compressed briquettes) similar to that available in developing countries. Stoves shall be tested with "dry" charcoal (approximately 5 percent moisture content on a wet basis). Charcoal shall be started (ignited) with 50 g of wood chips soaked in 10 grams of kerosene.

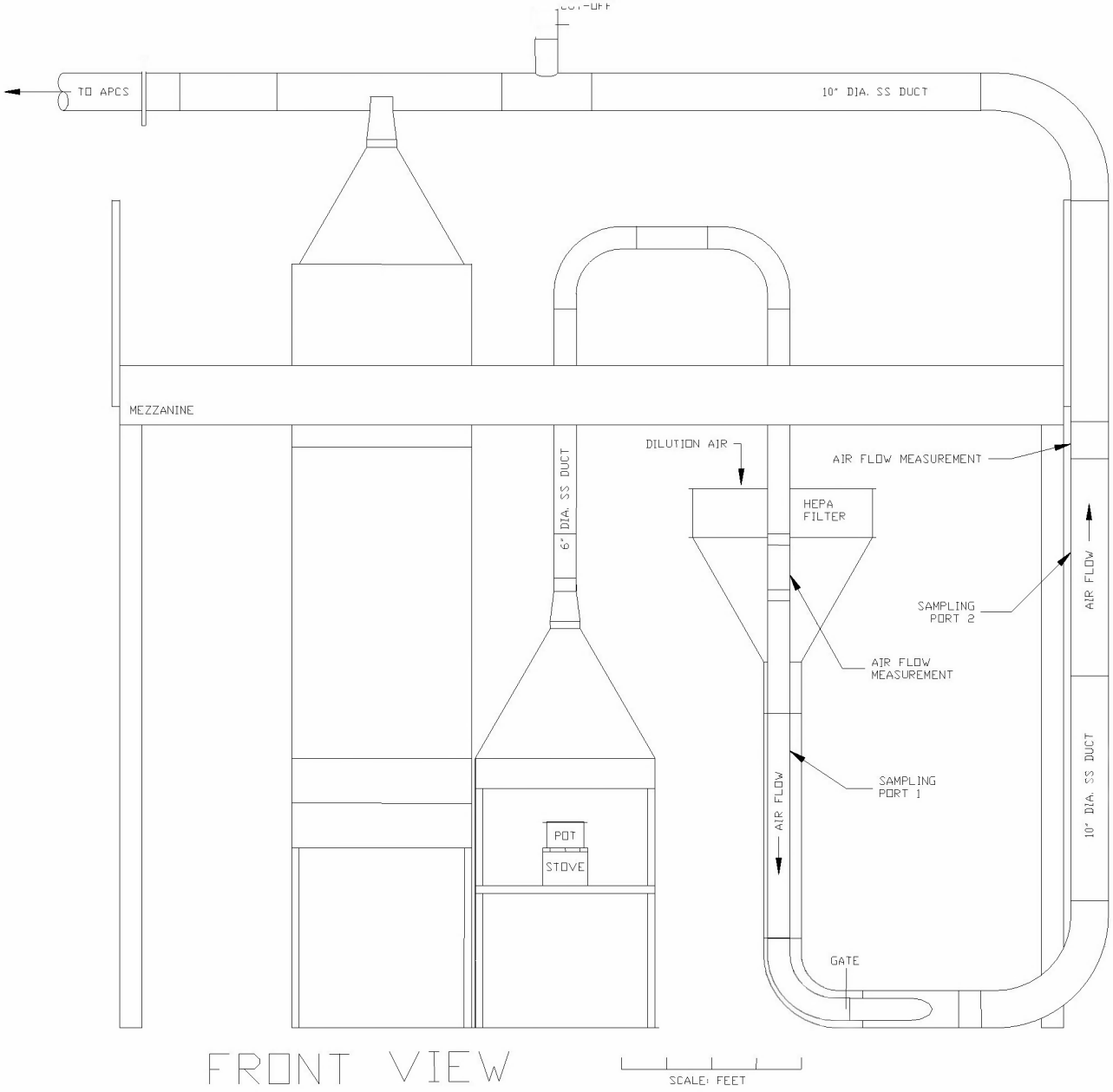

Figure 1. Mode 1: System configured for testing emissions from small cookstoves without chimneys

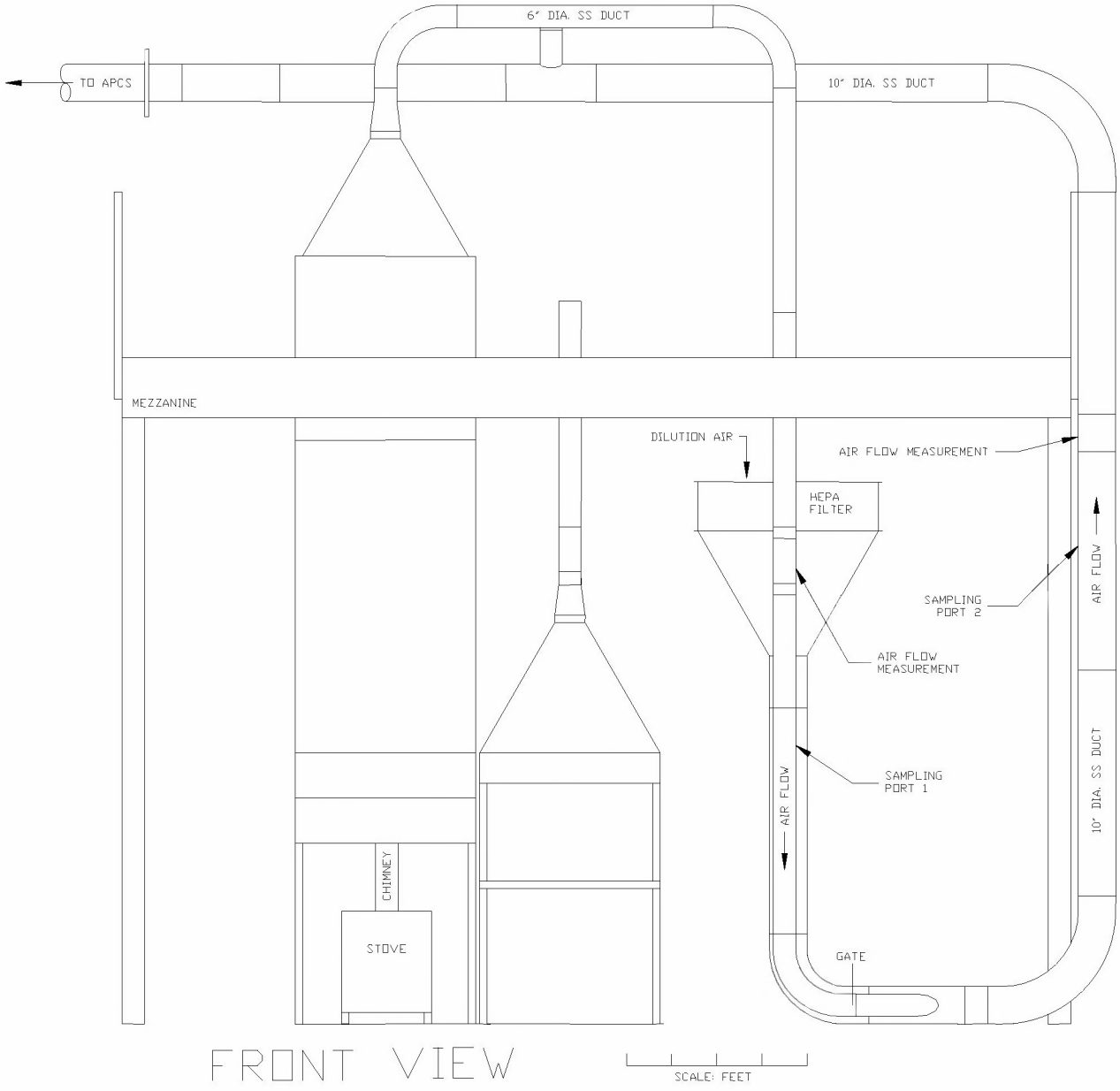

Figure 2. Mode 2: System configured for testing total emissions from stoves with chimneys

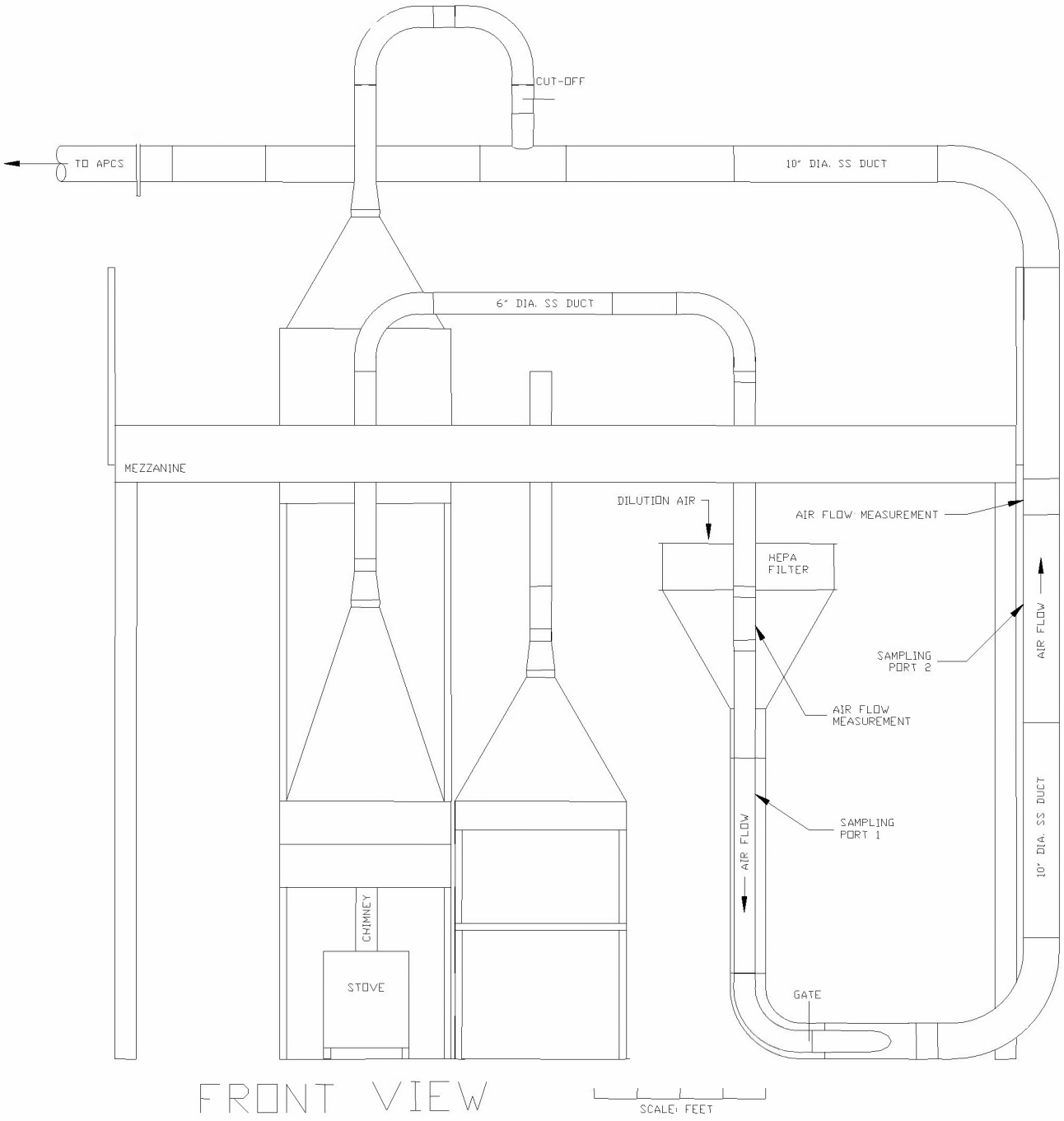

Figure 3. Mode 3: System configured for testing indoor air emissions from stoves with chimneys

All fuels shall be analyzed for moisture content using ASTM Standard Method D4442-92. Moisture content of the fuels shall be measured on each day of testing. A random sample of fuel wood, with a mass of approximately 100 g, shall be weighed with an electronic balance. The sample shall be dried in a ventilated oven for at least 8 hours, and then the sample shall be weighed again. The percent moisture content in the wood on a percent wet basis shall be calculated and recorded.

All fuels shall be analyzed for heat of combustion using ASTM Standard Method ASTM D5865-04. This testing shall be done by a qualified outside laboratory.

Air pollutants to be measured:
The contractor shall measure emissions of the following pollutants for each stove and fuel combination:

- CO_2 - real-time, CEM (IR)
- CO - real-time, CEM (IR)
- $PM_{2.5}$, measured gravimetrically, filter sample taken during each of the three phases of the WBT
- BC (black carbon) – real-time with aethalometer
- EC (elemental carbon) and OC (organic carbon) – quartz filter sample taken during each of the three phases of the WBT and analyzed with the thermal-optical method. Quartz "back-up" filter sample also taken during each WBT phase to quantify the gas-phase artifact
- PM, submicrometer particles measured with SMPS (scanning mobility particle sizer)
- THC (total hydrocarbon) - real time, FID total HC analyzer
- CH_4 (methane) - real time, FID analyzer
- Other pollutants may be added if resources (instruments and personnel) are available

The EPA will furnish instrumentation and equipment necessary to measure air pollutants.

BC/EC/OC analysis will be provided by EPA Emissions Characterization and Prevention Branch, contact: Michael Hays

Test protocol:
WBT (Water Boiling Test) latest version. The WBT is currently being revised. The EPA WAM will provide a copy of the updated protocol, when it is available.

A summary of the most recent performance test protocol follows:

"This modified version of the well-known Water Boiling Test (WBT) is a simulation of the cooking process that can be performed on most stoves in use throughout the world. While the test is not intended to replace other forms of stove assessment, it is designed to be a simple method by which stoves made in different places and for different cooking applications may be compared by a standardized and replicable protocol."

"The WBT …consists of three phases.

1) In the first phase, the tester begins with the stove at room temperature and uses a pre-weighed bundle of wood to boil a measured quantity of water in a standard pot. The tester then replaces the boiled water with a fresh pot of cold water to perform the second phase of the test.
2) In the second phase, water is boiled beginning with a hot stove in order to identify differences in performance between a stove when it is cold and when it is hot.
3) Lastly, the tester again boils a measured amount of water and then, using a pre-weighed bundle of wood, simmers the water at just below boiling for a measured period of time (45 minutes). The third step simulates the long cooking of legumes or pulses that is common throughout much of the world."

"This combination of tests is intended to measure the stove's performance at both high and low power outputs, which are important indicators of the stove's ability to conserve fuel."

Results

The contractor shall set up an automated system that will enable immediate data processing following each stove test (not including analysis of samples that require post-processing, e.g., filter samples).

The contractor shall deliver data to the EPA WAM in a format, such as Microsoft Excel, that can be easily analyzed. Results shall be reported as averages and standard deviations for the three tests for each stove. The contractor shall report data including all parameters in the WBT test protocol, and the data shall be in format similar to that used for WA 3-48.

Safety

The Contractor shall comply with a Health and Safety Protocol. The Contractor shall maintain a safe working environment during testing.

Quality Assurance

The contractor completed a QAPP (Level II) under WA 3-48, and work will continue under the existing QAPP. The contractor completed an internal technical systems audit, and the project was approved by an external independent quality assurance review. An internal audit of data quality shall be performed by the contractor. If any revision of the QAPP is required, the QAPP shall be reviewed and approved by the ARCADIS work assignment leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the ARCADIS work assignment leader and QA officer to show that they have reviewed and approved the revised QAPP. It is the responsibility of the ARCADIS work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Any

work involving environmental data shall not commence until the QAPP has received official approval from the EPA QA staff.

Reporting

The Contractor shall prepare and deliver brief, monthly progress reports in accordance with the reporting requirements in the contract. The contractor shall deliver data and filter samples to the EPA WAM. The final report will be prepared by the EPA WAM and will be in the form of a manuscript to be submitted to a peer-reviewed journal for publication. Contractor personnel may be coauthors of the publication.

Deliverables

Report on internal audit of data quality, raw test data, filter samples, and processed data shall be deliverables.

Schedule is as follows:

April 30, 2013	Complete internal audit of data quality
December 30, 2013	Complete cookstove testing
January 30, 2013	Deliver all filter samples
March 30, 2013	Complete data analysis and quality assurance

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-50

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	HAPs and Pm Investigation on a

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Tiffany Yelverton (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-9456 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 3-27-13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK

HAPs and PM Investigation on a Pilot-Scale Combustion Facility

I. Background

In 2012 EPA's Office of Air Quality Planning and Standards (OAQPS) promulgated a rule to requiring control of hazardous air pollutants (HAPs) from coal- and oil-fired electric utility boilers, known as the "Mercury Air Toxics Standard" or MATS" rule. The rule included the use of various surrogate measurements as a compliance option to demonstrate control of HAPs. NRMRL/APPCD has had an ongoing series of tests to evaluate the use of surrogates to infer control of select HAPs. This work assignment describes follow-on work to further investigate these surrogate measurements, as well as investigate and characterize particulate matter (PM) emissions using control devices. Another aspect of this study will be to use not only coal, but also several biomass options at varying blends rates. As with previous studies, this will utilize ORD's Multipollutant Control Research Facility (MPCRF) to test a range of coal types, biomass blends, and process configurations.

The MPCRF is located in the High Bay Building (HBB) on EPA's Research Triangle Park campus. It is a pilot-scale combustion research facility rated at 4MMBtu/hr (roughly 1.2 MWt). It is capable of firing pulverized coals (and/or biomass blended with coal), natural gas, and Number 2 fuel oil. This combustor is also equipped with several control technologies: (i) low NOx burners, (ii) a selective catalytic reduction (SCR) unit (with Cormetech catalyst), (iii) an electrostatic precipitator (ESP), (iv) fabric filters (positioned in parallel), and (v) a wet lime-based flue gas desulfurization (FGD) scrubber. The facility has the capability to use many of these control technologies simultaneously or can bypass a given control for individual investigation. Furthermore, the MPCRF is equipped with continuous emissions monitors (CEMs) for on-line measurement of O_2, CO_2, NO, NO_2, SO_2, CO, and Hg. There are multiple sampling ports throughout the gas flow path. The facility has several heat exchangers in series in order to remove heat such that the flow path of the flue gas has a similar temperature profile to that seen in a full-scale power plant.

II. Purpose

These tests will be used to further examine surrogacy relationships and PM characterization in order to inform OAQPS on the viability of the surrogacy approach. These tests will build upon similar testing from 2010 and 2011 but will incorporate more online (real-time) measurement techniques to avoid time-integrated filter samples (FTIR, aethalometer, etc.).

Furthermore, the tests will also investigate the emissions from blending biomass with coal under normal operating conditions of the MPCRF. The resulting data will be used by ORD and by OAQPS/OAR. The results of these tests will NOT be used to set emission limits or to determine the maximum achievable control technology.

Background Information and Special Instruction

- It is expected that much of the data obtained via this work assignment may be dispensed to the general public via open presentation at technical conferences and through publication in peer-reviewed scientific journals.
- The Contractor is expected to use government furnished equipment (GFE) for this work and shall work with the WAM to accomplish these tasks.
- Facility operating manuals and standard operating procedures shall be followed when applicable and available.
- The Contractor shall participate in safety training as per EPA guidelines.
- The Contractor shall adhere to the QA requirements as delineated in Attachment #1 to the Statement of Work. Any work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Stuff.

III. Statement of Work

Task 1. Revise/Combine the Existing QAPP

Prior to the start of the testing period, the contractor shall work with the WAM to review the existing QAPP, "Surrogacy Testing in the Multi-pollutant Control Research Facility (MPCRF)," in order to make any needed revisions or updates for sampling practices/methods and the test plan. It is likely that the current version of the QAPP will encompass all needed information, but the contractor shall work with the WAM to combine the existing QAPP and all approved revisions (3) into one approved document.

Deliverables – The contractor shall review the new/revised quality assurance project plan (QAPP) to ensure that it is in accordance with Appendix #1 to the Performance Work Statement for each work assignment task involving collection or generation of environmental data. The newest, complete/total version of the QAPP must be approved by the WAM prior to any data being acquired or used (by 06/30/2013).

Task 2. Conduct Runs According to the QAPP/Test Plan

Each test "run" shall be one 8-hour day of operation, where roughly 4-hours will be a sampling period. It is likely that two test runs per week, biweekly, shall occur. The contractor shall be responsible for coal preparation (pulverization, storage, etc.),

organization and storage as well as preparation of the sampling equipment and glassware for all of the runs; however, the contractor shall not be responsible for day-to-day operation of the MPCRF. The contractor shall, in coordination with the WAM, conduct experimental runs according to the schedule and conditions described in the existing/revised QAPP which includes testing up to four different types of coal and multiple configurations of the available PM, NO_x, and SO_2 control technology equipment on the MPCRF (as described in the below table).

Projected Conditions for Each Test

Coal Type	PM Control	NOx Control	SO2 Control	Number of Test Days
bituminous	ESP	SCR (with & without catalyst)	wet-FGD	2-4
bituminous	FF	SCR (with & without catalyst)	wet-FGD	2-4
PRB	ESP	SCR (with & without catalyst)	wet-FGD	2-4
PRB	FF	SCR (with & without catalyst)	wet-FGD	2-4
lignite	ESP	SCR (with & without catalyst)	wet-FGD	2-4
lignite	FF	SCR (with & without catalyst)	wet-FGD	2-4
Biomass blended with coal (coal type TBD)	ESP	SCR (with & without catalyst)	wet-FGD	12-14
Biomass blended with coal (coal type TBD)	FF	SCR (with & without catalyst)	wet-FGD	12-14
			Total	36-52

The contractor shall also support similar surrogacy testing conducted under a separate work assignment. This support will likely include organic HAPs (e.g, aromatic VOCs and

carbonyls) sampling and analysis. As this support is dependent on the collaborating work assignment, the actual support required and schedule will be provided in writing by the WAM at a later date. Therefore, while conducting these tests, the contractor shall also be responsible for support of other experimental sampling as described under a second work assignment (WA 3-2) as determined and submitted at a later date.

Deliverables – The contractor shall provide the WAM with pulverized coal, clean/ready to use test equipment/sample trains, and support for sample collection for all scheduled test days.

Task 3: Construction of Coal Blending Station

The contractor shall use the procured parts and equipment to construct a coal blending station with input from the WAM. The building plans will be provided by the WAM in order for the contractor to complete this construction. The contractor shall also be responsible for the procurement of smaller pieces of parts and equipment to complete the construction of the blending station. Some of the physical construction of the coal blending station from this purchased equipment shall be accomplished by the contractor, but under work assignment 3-1.

Deliverables – The contractor shall assemble a coal blending station such that the blending station is useable prior to testing with biomass. Further, the contractor shall notify the WAM of other needed parts prior to purchase and give at least bi-weekly verbal updates of progress on the blending station. The target date for completion of the construction of the blending station is no later than July 31, 2013.

Task 4: Coordinate Analysis of Experimental Samples

The contractor shall, when needed, coordinate the transport and analysis of experimental samples using appropriate off-site analytical laboratories. The specific analytical requirements will be described in the QAPP. While the exact number of samples to be analyzed off-site is unknown at this time, filters analyzed off-site for organic and elemental carbon concentrations (NIOSH5040), as well as potentially arranging wet-chemistry sample train analysis.

Deliverables – The contractor shall provide chain of custody reports for all samples sent off-site for analysis as well as the results reported from these analyses. For on-site sample analysis, the contractor shall provide results from analyses.

Task 5: Assemble Run Data and Analytical Results into a Usable Data Package and Provide a Written Summary

The contractor shall assemble the run data (experimental conditions, flue gas components, etc.) and analytical results into formats that can be used or reported. The contractor shall

work with the WAM to ensure that the appropriate data formats are used. The contractor shall write up a short summary report following each run and should further assemble analytical data into table and plot formats.

Deliverables – The contractor shall provide analytical results and the data package within two weeks of receiving analytical reports from the off-site laboratory.

Task 6: Purchase Needed Analytical Equipment

The Contractor shall purchase any needed equipment to analyze the flue gas generated from the combustion of coal blended with biomass. The equipment could include, but is not limited to: a portable FTIR or a single wavelength photoacoustic soot spectrometer. Further information regarding specific characteristics and parameters of the needed pieces of equipment will be provided by the WAM as needed.

Deliverables – The Contractor shall provide the needed equipment to be able to analytically characterize the PM and gaseous emissions from the combustion of the blended coal and biomass product(s). Further, the Contractor shall notify the WAM of arrival of all pieces of equipment such that the WAM can make arrangements for implementation and use of the instruments on the current testing.

IV. Other Deliverables

The Contractor shall provide the WAM with a records Package at the completion of the tasks of this work assignment. This records package shall contain copies of laboratory data sheets, experimental observations (in a lab notebook), minutes of meetings, etc. The records package shall contain enough information such that the work could be independently repeated if desired.

The Contractor's monthly report to EPA shall summarize work activities (accomplished and planned) for each task in this work assignment, including (but not limited to) the status of applicable tests, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges.

All safety and quality assurance requirements for APPCD projects are documented in protocols prepared prior to initiating a project, as required in the Contractor's contract. As part of the EPA-RTP's normal operational requirements, a detailed facility health and safety plan shall be prepared by the Contractor for each of the experimental systems that will be used for this proposed research. Health and safety protocols for each task shall be updated or prepared as required by the EPA-RTP Campus Safety personnel. These protocols shall be approved by the WAM and safety personnel prior to conducting any tests.

STATEMENT OF WORK

HAPs and PM Investigation on a Pilot-Scale Combustion Facility

I. Background

In 2012 EPA's Office of Air Quality Planning and Standards (OAQPS) promulgated a rule to requiring control of hazardous air pollutants (HAPs) from coal- and oil-fired electric utility boilers, known as the "Mercury Air Toxics Standard" or MATS" rule. The rule included the use of various surrogate measurements as a compliance option to demonstrate control of HAPs. NRMRL/APPCD has had an ongoing series of tests to evaluate the use of surrogates to infer control of select HAPs. This work assignment describes follow-on work to further investigate these surrogate measurements, as well as investigate and characterize particulate matter (PM) emissions using control devices. Another aspect of this study will be to use not only coal, but also several biomass options at varying blends rates. As with previous studies, this will utilize ORD's Multipollutant Control Research Facility (MPCRF) to test a range of coal types, biomass blends, and process configurations.

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II. Purpose

These tests will be used to further examine surrogacy relationships and PM characterization in order to inform OAQPS on the viability of the surrogacy approach. These tests will build upon similar testing from 2010 and 2011 but will incorporate more online (real-time) measurement techniques to avoid time-integrated filter samples (FTIR, aethalometer, etc.).

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The contractor shall also support similar surrogacy testing conducted under a separate work assignment. This support will likely include organic HAPs (e.g, aromatic VOCs and

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Deliverables – The contractor shall provide the WAM with pulverized coal, clean/ready to use test equipment/sample trains, and support for sample collection for all scheduled test days.

Task 3: Construction of Coal Blending Station

The contractor shall use the procured parts and equipment to construct a coal blending station with input from the WAM. The building plans will be provided by the WAM in order for the contractor to complete this construction. The contractor shall also be responsible for the procurement of smaller pieces of parts and equipment to complete the construction of the blending station. Some of the physical construction of the coal blending station from this purchased equipment shall be accomplished by the contractor, but under work assignment 3-1.

Deliverables – The contractor shall assemble a coal blending station such that the blending station is useable prior to testing with biomass. Further, the contractor shall notify the WAM of other needed parts prior to purchase and give at least bi-weekly verbal updates of progress on the blending station. The target date for completion of the construction of the blending station is no later than July 31, 2013.

Task 4: Coordinate Analysis of Experimental Samples

The contractor shall, when needed, coordinate the transport and analysis of experimental samples using appropriate off-site analytical laboratories. The specific analytical requirements will be described in the QAPP. While the exact number of samples to be analyzed off-site is unknown at this time, filters analyzed off-site for organic and elemental carbon concentrations (NIOSH5040), as well as potentially arranging wet-chemistry sample train analysis.

Deliverables – The contractor shall provide chain of custody reports for all samples sent off-site for analysis as well as the results reported from these analyses. For on-site sample analysis, the contractor shall provide results from analyses.

Task 5: Assemble Run Data and Analytical Results into a Usable Data Package and Provide a Written Summary

The contractor shall assemble the run data (experimental conditions, flue gas components, etc.) and analytical results into formats that can be used or reported. The contractor shall

work with the WAM to ensure that the appropriate data formats are used. The contractor shall write up a short summary report following each run and should further assemble analytical data into table and plot formats.

Deliverables – The contractor shall provide analytical results and the data package within two weeks of receiving analytical reports from the off-site laboratory.

Task 6: Purchase Needed Analytical Equipment

The Contractor shall purchase any needed equipment to analyze the flue gas generated from the combustion of coal blended with biomass. The equipment could include, but is not limited to: a portable FTIR or a single wavelength photoacoustic soot spectrometer. Further information regarding specific characteristics and parameters of the needed pieces of equipment will be provided by the WAM as needed.

Deliverables – The Contractor shall provide the needed equipment to be able to analytically characterize the PM and gaseous emissions from the combustion of the blended coal and biomass product(s). Further, the Contractor shall notify the WAM of arrival of all pieces of equipment such that the WAM can make arrangements for implementation and use of the instruments on the current testing.

IV. Other Deliverables

The Contractor shall provide the WAM with a records Package at the completion of the tasks of this work assignment. This records package shall contain copies of laboratory data sheets, experimental observations (in a lab notebook), minutes of meetings, etc. The records package shall contain enough information such that the work could be independently repeated if desired.

The Contractor's monthly report to EPA shall summarize work activities (accomplished and planned) for each task in this work assignment, including (but not limited to) the status of applicable tests, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges.

All safety and quality assurance requirements for APPCD projects are documented in protocols prepared prior to initiating a project, as required in the Contractor's contract. As part of the EPA-RTP's normal operational requirements, a detailed facility health and safety plan shall be prepared by the Contractor for each of the experimental systems that will be used for this proposed research. Health and safety protocols for each task shall be updated or prepared as required by the EPA-RTP Campus Safety personnel. These protocols shall be approved by the WAM and safety personnel prior to conducting any tests.

Furthermore, the tests will also investigate the emissions from blending biomass with coal under normal operating conditions of the MPCRF. The resulting data will be used by ORD and by OAQPS/OAR. The results of these tests will NOT be used to set emission limits or to determine the maximum achievable control technology.

Background Information and Special Instruction

- It is expected that much of the data obtained via this work assignment may be dispensed to the general public via open presentation at technical conferences and through publication in peer-reviewed scientific journals.
- The Contractor is expected to use government furnished equipment (GFE) for this work and shall work with the WAM to accomplish these tasks.
- Facility operating manuals and standard operating procedures shall be followed when applicable and available.
- The Contractor shall participate in safety training as per EPA guidelines.
- The Contractor shall adhere to the QA requirements as delineated in Attachment #1 to the Statement of Work. Any work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Stuff.

III. Statement of Work

Task 1. Revise/Combine the Existing QAPP

Prior to the start of the testing period, the contractor shall work with the WAM to review the existing QAPP, "Surrogacy Testing in the Multi-pollutant Control Research Facility (MPCRF)," in order to make any needed revisions or updates for sampling practices/methods and the test plan. It is likely that the current version of the QAPP will encompass all needed information, but the contractor shall work with the WAM to combine the existing QAPP and all approved revisions (3) into one approved document.

Deliverables – The contractor shall review the new/revised quality assurance project plan (QAPP) to ensure that it is in accordance with Appendix #1 to the Performance Work Statement for each work assignment task involving collection or generation of environmental data. The newest, complete/total version of the QAPP must be approved by the WAM prior to any data being acquired or used (by 06/30/2013).

Task 2. Conduct Runs According to the QAPP/Test Plan

Each test "run" shall be one 8-hour day of operation, where roughly 4-hours will be a sampling period. It is likely that two test runs per week, biweekly, shall occur. The contractor shall be responsible for coal preparation (pulverization, storage, etc.),

organization and storage as well as preparation of the sampling equipment and glassware for all of the runs; however, the contractor shall not be responsible for day-to-day operation of the MPCRF. The contractor shall, in coordination with the WAM, conduct experimental runs according to the schedule and conditions described in the existing/revised QAPP which includes testing up to four different types of coal and multiple configurations of the available PM, NO_x, and SO_2 control technology equipment on the MPCRF (as described in the below table).

Projected Conditions for Each Test

Coal Type	PM Control	NOx Control	SO2 Control	Number of Test Days
bituminous	ESP	SCR (with & without catalyst)	wet-FGD	2-4
bituminous	FF	SCR (with & without catalyst)	wet-FGD	2-4
PRB	ESP	SCR (with & without catalyst)	wet-FGD	2-4
PRB	FF	SCR (with & without catalyst)	wet-FGD	2-4
lignite	ESP	SCR (with & without catalyst)	wet-FGD	2-4
lignite	FF	SCR (with & without catalyst)	wet-FGD	2-4
Biomass blended with coal (coal type TBD)	ESP	SCR (with & without catalyst)	wet-FGD	12-14
Biomass blended with coal (coal type TBD)	FF	SCR (with & without catalyst)	wet-FGD	12-14
			Total	36-52

The contractor shall also support similar surrogacy testing conducted under a separate work assignment. This support will likely include organic HAPs (e.g, aromatic VOCs and

carbonyls) sampling and analysis. As this support is dependent on the collaborating work assignment, the actual support required and schedule will be provided in writing by the WAM at a later date. Therefore, while conducting these tests, the contractor shall also be responsible for support of other experimental sampling as described under a second work assignment (WA 3-2) as determined and submitted at a later date.

Deliverables – The contractor shall provide the WAM with pulverized coal, clean/ready to use test equipment/sample trains, and support for sample collection for all scheduled test days.

Task 3: Construction of Coal Blending Station

The contractor shall use the procured parts and equipment to construct a coal blending station with input from the WAM. The building plans will be provided by the WAM in order for the contractor to complete this construction. The contractor shall also be responsible for the procurement of smaller pieces of parts and equipment to complete the construction of the blending station. Some of the physical construction of the coal blending station from this purchased equipment shall be accomplished by the contractor, but under work assignment 3-1.

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The contractor shall, when needed, coordinate the transport and analysis of experimental samples using appropriate off-site analytical laboratories. The specific analytical requirements will be described in the QAPP. While the exact number of samples to be analyzed off-site is unknown at this time, filters analyzed off-site for organic and elemental carbon concentrations (NIOSH5040), as well as potentially arranging wet-chemistry sample train analysis.

Deliverables – The contractor shall provide chain of custody reports for all samples sent off-site for analysis as well as the results reported from these analyses. For on-site sample analysis, the contractor shall provide results from analyses.

Task 5: Assemble Run Data and Analytical Results into a Usable Data Package and Provide a Written Summary

The contractor shall assemble the run data (experimental conditions, flue gas components, etc.) and analytical results into formats that can be used or reported. The contractor shall

work with the WAM to ensure that the appropriate data formats are used. The contractor shall write up a short summary report following each run and should further assemble analytical data into table and plot formats.

Deliverables – The contractor shall provide analytical results and the data package within two weeks of receiving analytical reports from the off-site laboratory.

Task 6: Purchase Needed Analytical Equipment

The Contractor shall purchase any needed equipment to analyze the flue gas generated from the combustion of coal blended with biomass. The equipment could include, but is not limited to: a portable FTIR or a single wavelength photoacoustic soot spectrometer. Further information regarding specific characteristics and parameters of the needed pieces of equipment will be provided by the WAM as needed.

Deliverables – The Contractor shall provide the needed equipment to be able to analytically characterize the PM and gaseous emissions from the combustion of the blended coal and biomass product(s). Further, the Contractor shall notify the WAM of arrival of all pieces of equipment such that the WAM can make arrangements for implementation and use of the instruments on the current testing.

IV. Other Deliverables

The Contractor shall provide the WAM with a records Package at the completion of the tasks of this work assignment. This records package shall contain copies of laboratory data sheets, experimental observations (in a lab notebook), minutes of meetings, etc. The records package shall contain enough information such that the work could be independently repeated if desired.

The Contractor's monthly report to EPA shall summarize work activities (accomplished and planned) for each task in this work assignment, including (but not limited to) the status of applicable tests, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges.

All safety and quality assurance requirements for APPCD projects are documented in protocols prepared prior to initiating a project, as required in the Contractor's contract. As part of the EPA-RTP's normal operational requirements, a detailed facility health and safety plan shall be prepared by the Contractor for each of the experimental systems that will be used for this proposed research. Health and safety protocols for each task shall be updated or prepared as required by the EPA-RTP Campus Safety personnel. These protocols shall be approved by the WAM and safety personnel prior to conducting any tests.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-51

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014	
	Base X Option Period Number	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Worth Calfee (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7600 FAX Number: 919-541-0496
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 4-11-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK

DECONTAMINATION PROCESS INDICATORS: I. BIOLOGICAL INDICATORS AND II. PROCESS PARAMETER CORRELATIONS

PROJECT# C.2.3.1.04
(OMIS DCMD 3.49)
(APPCD ON-SITE CONTRACT EP-C-09-027 WA 4-51)

TABLE OF CONTENTS

I. TITLE

Decontamination Process Indicators: I. Biological Indicators and II. Process Parameter Correlations

II. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be from April 1, 2013 to March 31, 2014.

III. SUMMARY OF OBJECTIVES

This work shall continue the development of an improved biological indicator (BI), which not only relates closely to the decontamination of *Bacillus anthracis* contaminated building materials, but can be standardized for use in fumigation studies and future clean-up events. Additionally, correlations of successful inactivation of *B. anthracis* on relevant environmental surfaces (and, ultimately, the improved BI) with fumigation process parameters (e.g., fumigant concentration, dwell time, relative humidity, temperature) shall be developed. For example, once developed, this improved BI shall be used to determine efficacy of CD gas fumigation when environmental conditions are varied during the fumigation cycle.

IV. BACKGROUND/RELEVANCE

The results of on-going systematic decontamination studies using CD have shown a disconnect between the decontamination of standard BIs (*B. atrophaeus* on stainless steel), the required concentration – time product (CT) for building fumigations, and the laboratory studies of the decontamination of building materials contaminated with *B. anthracis*. For example, a CT of 9000 ppm-hrs was required for the building decontaminations with Sabre Technical Services, LLC, CD. BIs from APEX Laboratories (Sanford, NC) and have been used extensively during studies investigating the ability of CD gas to kill spores of *B. anthracis* and selected surrogates. The APEX BIs were used during EPA/ECBC systematic decontamination studies. Results of this study suggest that fumigation with CD to a CT of 4000-5000 ppm-hrs has consistently resulted in no growth of the BIs upon placement in tryptic soy broth (TSB). However, avirulent *B. anthracis* (NNR1Δ1) spores on building materials such as bare pine wood, painted I-beam steel, painted wallboard, and unpainted concrete cinder block have required considerably higher CT values to achieve no viable spores in samples recovered from building material. Recently, work conducted at EPA (DCMD 3.49 – FY09 through FY12) indicate APEX BIs can be modified to increase their resistance to CD. The study at hand shall continue this work, and progress toward the goal of creation of a biological indicator with resistance to CD similar to that of *B. anthracis* spores residing on building materials.

Additionally, it is often that prescribed environmental parameters during real-world decontaminations are not achieved for the duration of the fumigation. A data gap exists with regards to the effectiveness of fumigations under such dynamic environmental conditions. Understanding the effects of varying relative humidity and temperature during a fumigation event would allow remediation managers and on-scene coordinators to better make decisions as such dynamic conditions occur in the field.

V. SCOPE

The purpose of this work assignment is to continue development of BIs that can be used to more accurately indicate the effectiveness of a fumigation cycle for the decontamination of *B. anthracis* on 'hard to decontaminate materials'. Previous research conducted by the U.S. EPA Office of Research and Development (ORD) National Homeland Security Research Center (NHSRC) evaluated the effectiveness of CD technologies to decontaminate building materials contaminated with *B. anthracis*. Considering these data, this study shall attempt to create a BI that is inactivated at a CT (of CD) that approximates that required to kill *B. anthracis* on the materials most demanding of decontaminant. Previous field data have suggested that 9000 ppm-hours is required for complete inactivation of *B. anthracis* spores contained on or within such demanding materials. To this end, it is the objective of this study to develop a BI that is inactivated following 9000 ppm-hours exposure to CD. Recent research has identified organic additives that can increase the resistance of BI spores. This effort shall continue the optimization of the enhanced BI in order to increase its precision around the 9000 ppm-hours target inactivation point. Numerous combinations of C and T (e.g., 1000 ppm x 9 hours, 3000 ppm x 3 hours, etc.) shall be evaluated to determine the flexibility of these parameters within the 9000 target quotient. While inactivation following 9000 ppm-hours exposure to CD is the goal of this work plan, it should be noted that the approach outlined herein can be used to produce a BI that inactivates at another target exposure if desired.

VI. TECHNICAL APPROACH

Based upon the results of ongoing research, custom BIs shall be designed and produced in the same manner as described in the QAPP "Decontamination Process Indicators: Part 1 Biological Indicators. Part 2: Process Parameter Correlations". These custom BIs shall have burden concentrations that, based upon previous results, shall more precisely inactivate at the 9000 ppm-hours target. BIs shall be amended with numerous concentrations of various burden chemicals to achieve a 9000 ppm-hours target kill point (using 100 - 1000 ppmv CD). Once developed, the enhanced BI shall be tested and characterized over numerous time points, environmental conditions, and fumigant concentrations.

The following experimental approach shall be utilized during all fumigation tests:

(1) Pre-conditioning Phase (i.e., reach target temperature and relative humidity)
(2) Insertion of biological indicators and/or material coupons and sealing of the chamber (including leak check)
(3) Charging Phase (introduction of fumigant gas to the chamber at the specific feed concentration and flow rate)
(4) Decontamination Phase (maintaining a "steady-state" chamber fumigant concentration for a specified duration)
(5) Aeration Phase (removal of fumigant gas from the chamber feed gas and continuation of the experiment until the chamber fumigant concentration reaches the baseline concentration.)

If the time required for the charging phase is more than 1% of the time required for the dwell (decontamination phase), samples shall be inserted into the chamber during the decontamination phase (once the target concentration has been achieved), denoted as time zero. In all experiments, samples shall be removed from the chamber at intermittent times during the decontamination phase of a fumigation cycle. The chamber inlet and outlet flow rates should be equivalent; all experiments should be run at ambient pressure. The concentration within the test chamber shall be continuously monitored in real-time and at least once per half hour with titration samples during all phases of the fumigation (pre-conditioning, conditioning, charging, decontamination, and aeration).

VII. AFFORDABILITY

This effort is labor intensive, which is where the bulk of the funding is required. Equipment costs for this project are expected related to acquisition of coupon materials, burden materials, spores stocks, and experiment consumables (gloves, plates, reagents, etc.). All fumigations and microbiological sample analyses shall be conducted in-house unless agreed to by the EPA WAM for unforeseen circumstances. Preparation of spore stocks and inoculation of coupon materials may be preformed by a third-party commercial source upon approval of the EPA WAM.

VIII. RISK

The technical risk involved in this project is minimal. The data generated in the tasks listed in Section X will provide the necessary data to meet the objectives defined herein. Any unforeseen challenges shall be discussed with the WAM for immediate remediation in order to achieve the project objectives.

IX. FACILITIES AND MATERIALS

All tasks described in this SOW shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr., unless approved otherwise by the EPA WAM. The fumigation studies shall be conducted in the NHSRC's DTRL located in H-224 and H-222. The lab contains the necessary equipment (fumigant generator and monitoring equipment) for the tasks described herein. The analysis of the biological samples shall be conducted in the Microbiology lab, located in E-388. This SOW shall utilize this equipment for the fumigation and analysis needs of the tasks outlined herein.

X. TASKS

In order to achieve the multiple objectives discussed in this SOW, the following tasks can be defined directly from the scope of this work as detailed in the outline of the technical approach (Section VI):

(1) Design and testing of Custom BIs with concentrations of burden based upon previous data. Optimization of the 9000 ppm-hours target
(2) Testing of the 9000 ppm-hours inactivation point for the Custom BI(s) at numerous CD concentrations
(3) Report Preparation

These tasks are listed in order of priority. Each task must be completed before the next may begin. The deliverable dates shall be used by the WAL, in consultation with the EPA WAM, to determine the testing schedules.

TASK 1. Testing and Optimization of Custom BI(s)

In the first task, data from previous work shall be utilized to choose and test additional burden concentrations and/or coupon/burden combinations in order to create a Custom BI that more precisely inactivates at the 9000 ppmv-hours target. Since a limited number of burden concentrations were tested previously, Task I shall provide additional data for down-selection of appropriate burden materials and/or coupon materials for Custom BI creation. Custom BIs shall be prepared in the same manner as previously described in the QAPP "Decontamination Process Indicators: Part 1 Biological Indicators. Part 2: Process Parameter Correlations". Multiple concentrations of burden and replicates of each concentration shall be evaluated.

A) *Preparation of new iterations of Custom BIs based on previous data.* *Geobacillus stearothermophilus* and/or *Bacillus atrophaeus* spore stocks (approx. 1E8 cfu per mL) shall be spiked with burden materials prior to coupon inoculation onto stainless steel discs or coupon materials utilized in previous testing. For Task 1, ten burden concentrations shall be further evaluated (concentrations to be determined by the EPA WAM). Coupons shall be inoculated at 1E6 spores. A single Tyvek envelope shall be used to encase each BI.

B) *Develop a test/QA plan to accomplish the objectives described in this task.* The test/QA plan must be approved by the EPA WAM and NHSRC Quality Assurance Officer prior to the start of any work described in this statement of work. Revision of this test/QA plan based upon comments received from EPA shall also be conducted under this SOW. This test/QA plan shall also include the efforts under Task 2, Task 3 and Task 4 of this statement of work. All preparation and analysis performed by the Biocontaminant Lab shall be included in this test/QA plan. This test/QA plan can be written as an amendment to the QAPP entitled "Decontamination Process Indicators: Part 1 Biological Indicators. Part 2: Process Parameter Correlations".

C) Provide mock run data to the EPA WAM to prove the ability to maintain process conditions within the specification to be documented in the approved test/QA plan (Task 1B), including during the removal of samples during the decontamination phase of the fumigation cycle.

D) *Fumigation.* The resulting Custom BIs shall be challenged by fumigation with 100 - 1000 ppmv CD. Environmental conditions shall be 75% relative humidity (RH) (+/- 3% RH) and 75 ^{o}F (+/- 2 ^{o}F).

E) *Replicates*. Replicate test samples shall be collected at four to six time points (suggested exposure points include but are not limited to 1000, 5000, 7000, 8000, and 9000 ppmv-hours exposure to CD). In addition, three negative control (autoclaved coupon, with burden material, without inoculum, not fumigated), three positive control samples (not exposed to fumigation), three performance control samples (BI coupons with burden compound, without spore inoculum, fumigated, then added to inoculated growth media), and three burden turbidity control samples (BI coupons with burden compound, without spore inoculum, fumigated, then added to non-inoculated growth media), shall be collected and analyzed for each fumigation. In addition, three Apex COTS BIs (not enhanced) shall be exposed and collected at each time point, and evaluated for survivorship.

A) *Survivorship*. Spore survival shall be assessed qualitatively by growth / no growth determinations following attempted culture in Nutrient Broth or Tryptic Soy Broth, or quantitatively by spread-plate analysis. Five percent of negative growth tubes shall be further analyzed by plating 0.1 ml onto TSA plates, Five percent of all positive growth tubes shall be further analyzed by streaking a loop-full of culture liquid onto a TSA plate to confirm the identity of the organism. Spore survival on material coupons shall be determined quantitatively, by extraction, dilution plating, and enumeration of colony forming units (cfu). Quantitative assessment of spores survival on BI coupons may be requested.

F) Repeats of this test may be requested in order to determine variability in kill between multiple attempts at the same exposure (CT).

TASK 2. Testing of the 9000 ppm-hours kill point for the Custom BI(s) at numerous Chlorine Dioxide concentrations

In task 2, the product from task 1 shall be subjected to more extensive testing to verify its precise inactivation at 9000 ppmv-hours exposure to CD. At least three fumigations shall be conducted, each consisting of a unique target CD concentration. Samples shall be collected at up to six time points for each fumigation. Suggested CD concentrations include 300, 500, 750, 1000, and 3000 ppmv.

A) *Preparation of Custom BI based on previous data. Geobacillus stearothermophilus* and/or *Bacillus atrophaeus* spore stocks (approx. 1E8 cfu per mL) shall be spiked with burden materials prior to coupon inoculation onto stainless steel discs or coupon materials determined in previous testing. For Task 2, one Custom BI shall be evaluated for survivorship at 8000, 8500, 9000, 9500, 10000 ppmv-hours exposure to three different concentrations of CD. Coupons shall be inoculated at 1E6 spores. A single Tyvek envelope shall be used to encase each BI.

B) *Develop a test/QA plan to accomplish the objectives described in this task.* The test/QA plan must be approved by the EPA WAM and NHSRC Quality Assurance Officer prior to the start of any work described in this statement of work. Revision of this test/QA plan based upon comments received from EPA shall also be conducted under this SOW. This test/QA plan shall also include the efforts under Task 1, Task 3 and Task 4 of this statement of work. All preparation and analysis performed by the Biocontaminant Lab shall be included in this test/QA plan. This test/QA plan can be written as an amendment to the QAPP entitled "Decontamination Process Indicators: Part 1 Biological Indicators. Part 2: Process Parameter Correlations".

C) *Fumigation*. Suggested CD concentrations include 300, 500, 750, 1000, and 3000 ppmv (Final decision on concentrations shall be made by the WAM). Environmental conditions shall be 75% relative humidity (RH) (+/- 3% RH) and 75 ^{o}F (+/- 2 ^{o}F).

D) *Replicates*. Replicate test samples shall be collected at up to six time points. In addition, three negative control (autoclaved coupon, with burden material, without inoculum, not fumigated), three positive control samples (not exposed to fumigation), three performance control samples (BI coupons with burden compound, without spore inoculum, fumigated, then added to inoculated growth media), and three burden turbidity control samples (BI coupons with burden compound, without spore inoculum, fumigated, then added to non-inoculated growth media) shall be collected and analyzed for each fumigation. Thus, a total of 486 Custom BIs shall be needed for task 2.

B) *Survivorship*. Spore survival shall be assessed qualitatively by growth / no growth determinations following attempted culture in Nutrient Broth or Tryptic Soy Broth, or quantitatively by spread-plate analysis. Five percent of negative growth tubes shall be further analyzed by plating 0.1 ml onto TSA plates, Five percent of all positive growth tubes shall be further analyzed by streaking a loop-full of culture liquid onto a TSA plate to confirm the identity of the organism. Spore survival on material coupons shall be determined quantitatively, by extraction, dilution plating, and enumeration of colony forming units (cfu). Quantitative assessment of spores survival on BI coupons may be requested.

E) Repeats of this test shall not be required.

F) Confidence intervals of BI inactivation shall be calculated.

TASK 3. Report Preparation

In task 3, data from all previous work assignments (0-51, 1-51, 2-51, 3-51, and 4-51) shall be utilized to summarize the approach and results obtained.

In addition to experimental work involved for each part and tasks therein, the contractor shall also provide general support for maintaining the lab equipment. This support shall include:

- Provide assembly, maintenance, troubleshooting, and configuration support for any fumigant generation and monitoring equipment used for testing.

- Purchase any expendable materials, with prior approval from the WAM, for use in this project, including the building materials, chemicals, process gases, and instrument calibration gases.

XI. DELIVERABLE SCHEDULE

- Quality Assurance Project Plans (QAPPs): The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this work assignment (see Attachment #1 to the SOW) and the NHSRC QA requirement as defined in Attachment #2 to the SOW. The contractor shall prepare a QAPP in accordance with the type of research that is being conducted. For guidance on preparing a QAPP, the preparer should refer to the project specific requirements. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf. The contractor shall incorporate the test plan (or work plan) within the QAPP to produce a single document, referred to throughout this SOW as a test/QA plan. The test/QA plan shall include all efforts described in this statement of work.

- Health and Safety Research Protocols (HSRPs): Health and safety research protocols shall be updated, as needed, as required by the EPA Facility and APPCD safety personnel. Updates to these protocols shall be approved by the EPA WAM and safety personnel prior to the commencement of any testing.

- Monthly Task Progress and Cost Reports: The Contractor's monthly report to EPA shall summarize work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges. The ODC charges shall be documented in the report in a way that the items purchased, vendor, and cost are clearly indicated.

- Project Meetings: The EPA WAM and contractor's work assignment leader (WAL) shall arrange project meetings to discuss task-specific progress, issues, and action items. These meetings may be held at fixed times and fixed intervals, at the discretion of the EPA WAM.

- Facility Operating Manual: Any necessary revisions to the facility operating manual shall be prepared and provided to the EPA WAM within 45 working days after the start of testing on all three tasks.

- Transfer of Project Data: Transfer of project data shall occur at the conclusion of each experiment within each task or subtask. This data includes any generated data files (i.e., logged data) properly annotated, reports of the experimental conditions (e.g., concentrations, temperature, relative humidity, etc.), measured variables, and a listing of the samples awaiting further analysis. Data from samples requiring more time for analysis shall be transferred to the WAM once available.

- Data Summary: Within two weeks of the completion of each task, the contractor shall submit a summary of all data collected during that task. Rudimentary statistical analyses shall be conducted on the data (for example, means, standard deviations, ANOVA, etc.) The summary shall include the data from the biological sample analysis and the fumigation process parameter measurements. One summary from each task shall be prepared.

- Schedule: The following table (Table 1) outlines the deliverable schedule that the contractor shall meet for the period covered by this SOW. The schedule assumes a start date of award being 04/01/2013. Deliverable dates are dependent upon completion of specific tasks and shall be updated based on discussions between the contractor WAL and EPA WAM during the development of the test plans to cover the work specified herein.

Table 1: Deliverables Schedule

Deliverable	**Completion Date**
Submit draft test / QA Plan / QA amendments	3 weeks after date of award
Submit final test / QA Plan / QA amendments	2 weeks after receiving comments from EPA
Draft Report	02/01/2014
Final Report	2 weeks after receiving final comments from EPA
Updated Facility Manual	TBD, as req.

XII. REPORTING REQUIREMENTS

- The Contractor shall prepare Quality Control data reports of all facility-specific data. Each Quality Control report shall be in a format suitable for EPA/NHSRC publication and shall discuss how well various measurements described in the QA plan were met.

- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the

contractor for use on the projects discussed herein.

- All data worksheets generated as discussed in Section X shall be provided in electronic format in Excel.

- In lieu of a final technical report, journal articles may be submitted at the discretion of the EPA WAM. The papers shall be authored or co-authored by the EPA WAM, at the discretion of the WAM.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-52

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014	DECONTAMINATION OF HEAVILY SOI
	Base X Option Period Number	

Contractor	Specify Section and paragraph of Contract SOW
ARCADIS U.S., INC.	Sections 1, 2, and 6 of contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Contract Period: 04/01/2009 To 03/31/2014	Cost/Fee:	LOE:
This Action:			
Total:			

Work Plan / Cost Estimate Approvals

Contractor WP Dated:	Cost/Fee:	LOE:
Cumulative Approved:	Cost/Fee:	LOE:

Work Assignment Manager Name: Worth Calfee (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7600 FAX Number: 919-541-0496
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates 12/20/13 (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-53

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	PM Air Toxics from Commercial

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: John Kinsey (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-4121 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 3/21/13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK
Work Assignment No. 4-53

Title: PM/Air Toxics from Commercial Aircraft Engines

Work Assignment COR:

John Kinsey
U. S. Environmental Protection Agency
National Risk Management Research Laboratory
NRMRL-APPCD, MD E343-02
Research Triangle Park, NC 27711
(919) 541-4121; Fax (919) 541-0359
E-mail: kinsey.john@epa.gov

Background:

During Work Assignments (WA) 2-53 and 3-53, the draft of a peer-reviewed journal article was prepared reporting the results of the NASA-sponsored Alternative Aviation Fuel Experiment (AAFEX). Due to other more important commitments, this article was never completed. This work will continue in the current WA with submission to the journal planned.

In addition, the black carbon instrument validation study being performed during WA 2-53 and 3-53 is now close to completion. There is still one experiment characterizing the modified multi-angle absorption photometer (SuperMAAP) which needs to be conducted before the draft final report for the study can be completed. In addition, as a follow-up to this program, field testing at Wright-Patterson Air Force Base was conducted in late September 2012. The data reduction for this study is essentially complete, but a journal article reporting the results is required as a Product under ACE Task 066.

Scope of Work:

Task 1: The contractor shall continue to provide technical support during the preparation of a peer-reviewed journal article(s) outlining the results of the NASA Alternative Aviation Fuel Experiment (AAFEX). This support shall include responding to quality assurance and peer review comments, as applicable. The contractor shall also provide preparation and production support for the final document, as needed.

Task 2: The contractor shall continue to provide technical support to the black carbon instrument validation study conducted in the High Bay building. This support shall include activities such as final data collection, analysis, and reporting based on the testing conducted during the remainder of this Option

Period. The contractor shall also provide support on an as-needed basis during preparation of the final report for this program.

Task 3: Finally, the contractor shall provide support to the preparation and submission of a draft journal article on testing conducted in September 2012 at Wright Patterson Air Force Base. This support may include final data analyses as well as responding to quality assurance and peer review comments, as applicable.

Work Schedule:

Task 1:	Submit revised draft manuscript for review by November 1, 2013
Task 2:	Draft final report for peer review by July 1, 2013
Task 3;	Completion of draft journal article by August 1, 2013

Quality Assurance:

The contractor shall develop quality assurance documentation as required in Appendix 1 to this Statement of Work. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance staff. Approved quality assurance project plans (QAPPs) are currently available for all tasks outlined above.

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW) FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function; 07/14/08 A-2
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

□ **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

□ **QAPP Requirements for Software Development Projects**

□ **QAPP Requirements for Method Development Projects**

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

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NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-54

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014	
	Base X Option Period Number	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Scott Moore	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-5104 FAX Number:
Project Officer Name: Kevin Sudderth	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates	William Yates (Signature)	3-27-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

SOW FY 2013-2014
Period of Performance: 04/01/2013 – 03/31/2014
Work Assignment Manager (WAM): Scott A. Moore
Work Assignment Title: NHEERL MED Metrology QA Laboratory Support
Contract Number: EP-C-09-027
Work Assignment Number: 4-54

Introduction

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To ensure good QA it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to assure that it produces reliable data. The National Health and Environmental Effects Research Laboratory/Mid-Continent Ecology Division (NHEERL-MED) require that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (MetLab) provides QA assistance to NHEERL-MED researchers by providing the procedures and the standards to calibrate various scientific devices.

I. Goal/Purpose

The objective of this Work Assignment (WA) is to provide MetLab support to NHEERL-MED. The MetLab is a facility with the capabilities to check (or audit) the calibration of measurement instrumentation. A second objective is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to ensure and document that operations performed in EPA facilities produce data of a known and adequate quality. This work assignment does not pertain to the calibration of facility devices such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons because these are not used to produce data for EPA research products.

II. Background Information

Data Uses — Primary users of the products of this WA will be researchers and operators of equipment in EPA/NHEERL/MED facilities. Calibration and PEA results shall be reported in research reports to support or verify findings.

MetLab Site — Work area is D360-A, D362, and D364-A in EPA's Research Center in Research Triangle Park, NC.

Experience — Personnel assigned to this WA must be capable of performing the tasks listed in Section III (Tasks), which include electrical work, plumbing, general experience with lab equipment and materials, a familiarity with the calibration of measurement devices, and a fundamental understanding of the principals behind the measurements and the ability to reduce data and report it according to the International Organization for

Standardization ISO 17025 "General Requirements for the Competence of Calibration and Testing Laboratories" (ISO 17025) standard and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

III. Tasks: Metrology Quality Assurance Lab Support for NHEERL-MED

Task 1. Metrology Quality Assurance Lab Support for NHEERL-MED Pipettes

The Contractor shall perform pipette calibrations that conform to the NHEERL-MED Calibration SOPs or ISO 17025 and the GUM. All of these devices will be mailed to the Met Lab or a Designated Specialist selected by the contractor for calibration. NHEERL-MED will pack and mail (via any carrier such as UPS, FedEx, USPS or other) all of the devices (i.e. pipettes) to be calibrated to the Contractor or Designated Specialist. NHEERL-MED will be responsible for those shipping charges. The Contractor shall maintain a record and data base of all equipment calibrations and calibration schedules. The following devices from NHEERL-MED will be calibrated by the Metrology Lab:

a) Total of 600 pipettes. NHEERL-MED would like to maintain a schedule of calibrating 150 pipettes (or ¼ of their total volume) every 3 months.

IV. Deliverables (Applies to all Tasks)

The Contractor shall provide the following reports for NHEERL-MED

(1) Monthly reports of the laboratory support activities including the following:
   a) The number of and type of calibrations performed.
   b) Any costs incurred during calibration activities.
   c) Any maintenance activities performed.
   d) Any documentation activities performed.

(2) Special reports as requested via Technical Directive by the WAM.

(3) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WAM shall be notified and the WAM will provide technical direction to the contractor for prioritization.

(4) The WAM shall be copied on all correspondence to and from any laboratories and vendors used in the completion of the tasks associated with the projects. Any documents or literature received during any of these correspondences shall also be made available to the WAM.

(5) The contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(6) The contractor shall use formatting of reports that is comparable to historical reporting and electronic files should be compatible with Agency Standard Software, such as MS Excel 2007, MS Word 2007 and Adobe Reader 9.0 or current agency standard software. Hard copies of reports are acceptable; however, electronic copies are encouraged.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-55

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Development of the USEPA Unive

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Gurbakhash Bhander (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-7542 FAX Number: 919-541-0554
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 6-11-13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

PERFORMANCE WORK STATEMENT

TITLE: Development of the U.S. EPA Universal Industrial Sector Integrated Solution Modules.

Period of Performance: Date of Award through March 31, 2014

Work Assignment Manager (WAM):
Dr. Gurbakhash S. Bhander
U.S. Environmental Protection Agency
Office of Research and Development
Air Pollution Prevention and Control Division (MD- E305-01)
Research Triangle Park, NC 27711
Phone (919) 541-7542
Phone: (919) 541-7542 Fax: (919) 541-0554
Email: bhander.gurbakhash@epa.gov

I. Purpose

The Purpose of this Work Assignment (WA) is to provide services to the U.S. Environmental Protection Agency's (EPA), Office of Research and Development (ORD), National Risk Management Research Laboratory (NRMRL), Air Pollution Prevention and Control Division (APPCD), in assisting with the development of the Energy and Industrial Sector Integrated Solutions models, data collection and documentations.

The work assignment shall support industrial sectors (pulp and paper, cement and power) data collection, modules development, and documentation (user manual, reports articles). This WA is entitled *"Development of the U.S. EPA Universal Industrial Sectors Integrated Solution modules"*. This WA is intended to describe the work that the contractor shall help the EPA personals to complete. Deliverables for this WA shall include technical memorandum reflecting current status of each task and relative documentation.

II. Background

Optimizing our nation's clean air investments requires simultaneous consideration of multiple air quality goals. ORD and OAQPS are moving EPA toward a more integrated multi-pollutant approach to environmental protection (referred to as the "multi-pollutant, sector-based approach"). The development of sector-based and multi-pollutant approaches to manage emissions and air quality requires analyses of a myriad of inter-related engineering and economic factors. Such analyses are not possible without an appropriate modeling framework.

To meet this challenge, ORD and OAQPS are collaborating to develop the Universal Industrial Sectors Integrated Solutions (UISIS) Model. Recognized by the Clean Air Act Advisory

Committee (CAAAC) in their recent recommendations to EPA[1] and by Resources for the Future (RFF) as an integrated modeling tool, UISIS provides a dynamic framework to investigate, develop, and evaluate approaches to reducing emissions. UISIS is designed to provide information on optimal industry operations and emission reductions under alternative regulatory approaches. The model identifies the suite of cost-effective controls needed to meet alternative emission standards, as well as estimates the cost of controls and economic responses of the industry to regulatory alternatives.

EPA has implemented the first version of the UISIS model in the US Portland cement Industry:

- To perform both the engineering cost and economic analysis for the Portland Cement National Emission Standards for Hazardous Air Pollutants (NESHAP)
- To calculate the emission reduction for the Portland Cement NESHAP and NSPS(New Source Performance Standards)
- To forecast the revenue of the cement industry

UISIS has been expanded to include the pulp and paper and Iron and steel sectors. Preliminary versions of the pulp and paper sector and iron and steel sector modules are under development. These modules will be used

- To investigate control options and provide early guidance for rule development;
- To develop internal planning and strategies to answer potential petitions for reconsideration of recently issued standards;

To support the development of Economic Impact Analyses (EIA), a key component of regulatory analysis.

III. Statement of Work

This statement of work is intended to describe the work that the contractor shall complete relative to the UISIS model. The Contractor shall conduct the following steps in accomplishing the objective of this work assignment. In general, the contractor shall provide UISIS model development and operational support for the inclusion of the Pulp and Paper and cement sectors' models development and relative documentation completion. The detailed requirements include:

a) All tasks performed by the contractor in this effort shall be initiated by the work assignment manager (WAM) through technical directions;

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[1] Moving Towards Multi-Air Pollutants Reduction Strategies in Major U.S. Industry Sector. A Report to the U.S. Environmental Protection Agency from the Clean Air Act Advisory Committee. November 17, 2011, (http://www.epa.gov/air/caaac/pdfs/reduction_strategies.pdf)

b) If needed, the contractor shall schedule a 15-30 min. conference call every 2nd Thursday to clarify outstanding questions and confirm the deliverable schedules;
c) The contractor shall provide written progress memos every 2nd week to WAM for the duration of the WA.
d) Should developments arise that would affect the conduct or the schedule of the WA, the Contractor shall initiate additional communication with WAM.

IV. TASK 1: Pulp and Paper module development

The Contractor shall work with the WAM to provide UISIS model development and operational support for the inclusion of the pulp and paper sector module. This task should be carried out by an individual with in-depth knowledge of the UISIS module coding and operation. Much of this work may necessitate being performed on-site at EPA RTP facilities in order to interact with UISIS project team. In completion of this WA, the Contractor shall provide support for the following:

Task #1.1: Kickoff Meeting: The Contractor shall participate in an informal meeting with the EPA-UISIS project team and the WAM. The objective of this meeting is to provide an opportunity for the Contractor to ask questions and to develop an understanding of UISIS and the objectives of this WA prior to completion of the Contractor's Work Plan.

Task #1.2: Work Plan: The Contractor shall develop a new work plan. The Contractor shall hold conference calls with the WAM on at least a biweekly basis after approval of the work plan to plan and review progress of this WA.

Task 1.3: Write/Update and documentation and manuscripts - The Contractor shall work with the WAM to update existing chapters and write new chapters of the pulp and paper documentation report. This report shall be in the form of an appendix to the overall UISIS module quality assurance document. In completing this work, the Contractor shall:

- Update existing chapters – data, data processing procedure and references,
- Develop necessary pulp and paper module calibration chapter and used data and procedures, and
- Assist with preparing the pulp and paper module case study,
- Interpret results and write a chapter.

Task 1.4: Module calibration and testing – the Contractor shall help UISIS project team to collect and process data for a comprehensive calibration of the module. For this purpose the Contractor shall collect historical data and process it to calibrate pulp and paper module. Any modification of the UISIS pulp and paper module to be compatible with industry data and functionality for this sector such that base- and policy-case runs may be performed which predict sector

behavior within order-of-magnitude accuracy. In addition, the Contractor shall prepare documentation report of the calibration procedure.

Task 1.5: module, documentation and articles release – the contractor shall work with:

- Preparing user manual and module testing,
- Processing data, modifying/review necessary files and prepare a package for external release,
- Writing manuscripts, articles and reports for external release.

The Contractor shall adhere to the following schedule

Task	Deliverable	Delivery Schedule
1	Kick-off Meeting	10 days after effective date of WA
2	Work Plan	20 days after effective date of WA
3	Documentation and scripts	December 31, 2013
4	Completion of calibration and testing	August 31, 2013
5	Module, documentation and article release	December 31, 2013

V. TASK 2: UISIS Cement Module Development

The Contractor shall assist with the EPA-UISIS team to improve cement modeling (2nd generation) framework and operational support for the inclusion of the cement sector. In completion of this task, the Contractor shall provide support for the following:

Task 2.1: Updating Documentation – The Contractor shall work with EPA personnel to update necessary documentation as determined by WAM which includes:

1) Update cement data, calibration and results chapters,
2) Module testing case example (case studies) and documentation.

Task 2.2: Data Processing and case example – the Contractor shall help EPA-UISIS project team in updating 2010 data and processing data for a comprehensive calibration of the cement module. For this purpose, the Contractor shall update the cement workbook (inputs spreadsheet) and prepare historical data for the cement module calibration. Any modification of the UISIS cement module to be well-matched with industry data and functionality for this sector such that base and policycase runs may be performed which predict sector behavior within order-of-magnitude accuracy. The Contractor shall also prepare documentation report of this calibration procedure.

Task 2.3: module, documentation and articles release – the Contractor shall assist with:

- Preparing user manual and module testing reports,

- Processing data, modifying/review necessary files and prepare a package for external release,
- Writing manuscripts, articles and reports for external release.

The Contractor shall adhere to the following schedule

Task	Deliverable	Delivery Schedule
1	Documentation and scripts	August 31, 2013
2	Module testing and case study	July 31, 2013
3	Module and documentation release	December 31, 2013

V. TASK 3: Climate change and energy modeling support

The Contractor shall assist with the WAM to collect and process data, generate reports and publication for the inclusion of the climate change and power sector.

Task 3.1: Data collection and processing – The Contractor shall collect and examine data as determined by the WAM as well as support the WAM to analyze data and generate reports and publications. This task shall include:

- Data collecting and process – Hydrogen fuel, Natural Gas, Biomass and Coal to produce power,
- Data analysis and interpretation,
- Compiling and rescaling data using Excel model

Task 3.2: Modeling support – the contractor shall help the WAM in modeling and models development to model hydrogen fuel for gas turbine.

The Contractor shall adhere to the following schedule

Task	Deliverable	Delivery Schedule
1	Data collection and processing	Ongoing
2	Modeling support	Ongoing

VI. Acceptance Criteria

Deliverables shall be provided to the WAM as prescribed by the schedule of deliverables.

TITLE: Development of the U.S. EPA Universal Industrial Sector Integrated Solution Modules.

VII. QA Requirements:

The Contractor shall review the existing quality assurance project plans (QAPP), for data collection and for modules development, to ensure that it is in accordance with UISIS to the Performance Work Statement for each work assignment task involving collection or generation of environmental data and UISIS development. Any modifications in QAPP or WA must be approved by the WAM prior to any task. The monthly progress reports for each WA must describe QAPP activities undertaken during the reporting period.

VIII. Reporting Requirements:

The Contractor shall provide monthly progress reports in accordance with the terms of the contract. The Contractor shall submit work products in electronic as well as hard copy form. In addition, the Contractor shall deliver to the WAM each draft and final report in electronic format that is readable by windows-based word-processing, graphics (Microsoft PowerPoint), spreadsheet (Excel), and database (Access) programs. The Contractor shall also provide electronic copies of reports in PDF format.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-57

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Capture of Methyl Bromide Emis

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Joe Wood (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-5029 FAX Number: 919-541-0496
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates (Signature) 3-29-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK

Capture of Methyl Bromide Emissions

OMIS DCMD C.2.3.2.01
APPCD ON-SITE CONTRACT EP-C-09-027

I. PERIOD OF PERFORMANCE

The period of performance for this work assignment (WA) shall be from April 1, 2013 to March 31, 2014.

II. SUMMARY OF OBJECTIVES

This WA is a continuation of work begun under WA 3-57. This work will involve evaluating techniques for the capture of methyl bromide (MeBr) emissions under simulated anthrax fumigation conditions. In particular, tests shall be conducted to determine how the efficacy of MeBr capture is affected by different sorbent materials and operational factors.

III. BACKGROUND

Methyl bromide is an effective fumigant for the inactivation of *Bacillus anthracis* bacterial spores, and is relatively easy to use and inexpensive compared to other fumigants used for anthrax decontamination. Because of these attributes, in a wide area release of anthrax spores, MeBr could potentially be a critical decontamination technology. Additionally, although MeBr depletes stratospheric ozone and its use is restricted by EPA and international treaties, it is still a widely used fumigant for various critical uses. Developing data that demonstrate the effectiveness of different sorbents to capture MeBr would help to promote the use of this important anthrax decontamination technology. Although some research has been conducted that has demonstrated the capture of MeBr on activated carbon, said research was conducted at conditions not representative of the fumigation conditions required for anthrax decontamination. That is, tests need to be conducted at much higher MeBr concentrations and elevated temperature and relative humidity (RH) levels.

IV. TECHNICAL APPROACH

Experiments will be conducted at the laboratory scale using MeBr purchased for this study, to quantify adsorption capacity of the sorbent materials at different temperatures (i.e., to develop isotherms). Experimental variables will be developed in consultation with the WAM in the development of the Quality Assurance Project Plan (QAPP), but could include the use of different activated carbon materials, varying temperature, relative humidity, and flow rate.

V. AFFORDABILITY

This effort is labor intensive, which is where the bulk of the funding is required. Normal expendable laboratory items are also required for this project.

VI. FACILITIES AND MATERIALS

All tasks described in this SOW shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr.

VII. TASKS

No work conducted under this WA shall duplicate work conducted under previous work assignments, unless directed by the WA manager (WAM), and in order to troubleshoot problems from previous work and to assess repeatability (precision) of the data gathered previously. This WA is a continuation of work begin under WA 3-57.
The Contractor shall perform the following tasks:

1. Conduct experiments to develop isotherms for MeBr capture on sorbent materials. Isotherms based on tests at four concentrations shall be developed for two temperatures at two RH levels, for two different sorbent materials. At the discretion of the WAM, additional sorbents may be added to the test matrix while testing at only one RH level. These experimental parameters shall be developed in consultation with the WAM.

2. Provide general support for maintaining the lab equipment. This support shall include assembly, maintenance, troubleshooting, and configuration support for the any equipment used for testing. Support shall also include the purchase of any expendable materials, with prior approval from the WAM, for use in this project.

3. Report the results of all tests to the WAM as soon as possible via email and through the use of the DTRL share drive. The WAM shall be notified immediately of any problems encountered in the laboratory or with the results obtained. These data shall include any generated data files (i.e., logged data) properly annotated, reports of the experimental conditions, calibration checks, measured variables, and a listing of the samples awaiting further analysis.

4. Analyze the data per the requirements in the QAPP and in consultation with the WAM, and report the results of these analyses as soon as possible via email and through the use of the DTRL share drive. The expected data analyses would be in the form of Excel spreadsheets or other appropriate software.

5. Meet with the WAM at least every week to provide a project status update. The update shall include a synopsis of activities taking place the past week, problems encountered, and work planned for the next week.

6. Update the health and safety research protocols, as needed, as required by the EPA Facility and APPCD safety personnel. Updates to these protocols shall be approved by the EPA WAM and safety personnel prior to the commencement of any testing. The contractor shall provide a copy of the health and safety plan to the WAM and the ORD-Safety Office for discussion.

7. Prepare monthly reports that summarize work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges. The ODC charges shall be documented in the report in a way that the items purchased, vendor, and cost are clearly

indicated.

8. Prepare a report which includes details on the methods used, results, and QA procedures and results.

VIII. DELIVERABLE SCHEDULE

The following table outlines the expected schedule that the contractor shall meet for the period covered by this SOW. The schedule assumes a start date of April 1, 2012. Dates dependent upon completion of specific tasks shall be updated based on discussions between the contractor WAL and EPA WAM during the development of the test plans to cover the work specified herein.

Suggested Deliverable Schedule

Deliverable	**Completion Date**
Submit work assignment plan	4/15/13
Complete Task 1	2/15/14
Complete Task 8	3/15/14
Complete other tasks	ongoing

IX. REPORTING REQUIREMENTS

- The Contractor shall prepare a brief memorandum to the WAM which discusses how well various measurements described in the QA plan were met.

- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.

- All data and analyses worksheets generated as discussed in Section VII. shall be provided in electronic format in Excel and/or other appropriate software, in consultation with the WAM.

X. QUALITY ASSURANCE

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The contractor shall prepare a QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.

NHSRC QUALITY ASSURANCE REQUIREMENTS FORM
Attachment 1 to the Statement of Work

I GENERAL INFORMATION

Title:	Capture of Methyl Bromide Emissions	
Description:	Tests to assess adsorption of MeBr on activated carbon	
Project ID:	C.2.3.2.01	
Status:	Original	
Number Ammended:		
QA Category:	III	
Action Type:	Extramural	
Peer Review Category:	IV	
Security Classification:	Unclassified	
Project Type:	Applied Research	
QAPP Status 1:	Under Review	
QAPP Status 2:	Under Review	
QAPP Status 3:	Under Review	
Vehicle Status:	Existing Vehicle	
Vehicle Type:	Vehicle Number:	EP-C-09-027
	Work Assignment Number:	4-57
	Delivery/Task Order Number:	NA
	Modification Number:	NA
	Other:	NA

*If you are processing an **IAG** or **CRADA**, the responsibility for QA must be negotiated within the agreement. The TLPs in consultation with the QAMs in the various organizations must agree on, and document, which organization will take the lead for QA, the names of the QAM and TLP from each organization, and the QA requirements that will be adhered to during the agreement. Include this info in the IAG/CRADA package.*

II SCOPE OF WORK

Yes — Does the Statement of Work contain the appropriate QA language?

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with the R-2 and R-5 and/or the attachments provided with the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf

Yes — Does this extramural action involve the collection, generation, use, and/or reporting of environmental data; the design, construction, and operation of environmental technologies; or development of software, models, or methods?
(If "No" then skip to Section IV, and sign the form.)

No — Will the SOW or any subsequent work assignments or task orders involve any cross-organizational efforts within EPA?

Yes — Has a QAPP already been approved for the activities specified in the SOW?

Provide the title, date or revision number, and date of QA approval:

QAPP for capture of methyl bromide emissions, 10/2/2012

Does the QAPP require *any* revision by the contractor**

no

No Is an applicable QAPP in the process of being prepared, revised, or approved by EPA personnel for future use by the contractor? (QA approval must be obtained before the contractor can start work.)

** *The term "contractor" applies loosely here, such that as applicable, this term can also mean "awardee", "cooperator" and/or "grantee". Likewise, the term "contract" includes "agreements" and other vehicles.* ?

III QA DOCUMENTATION OPTIONS

All documentation specified under "Other" must be defined in the NHSRC Quality Management Plan and be consistent with requirements defined in EPA Manual 5360 A1. For all items checked below, there must be adequate information in the SOW (or its appendices) for the offeror to develop this documentation. Where applicable, reference a specific section of the SOW. *(R-2 refers to EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, 03/20/01) and R-5 refers to EPA Requirements for Quality Assurance Project Plans (QA/R-5) (EPA/240/B-01/003, 03/20/01). Copies of these documents are available at http://www.epa.gov/quality/qa_docs.html.)*

After Award Documentation

R2	Documentation of an organization's Quality System. QMP developed in accordance with:
R2 and R5	Combined documentation of an organization's Quality System and application of QA and QC to the single project covered by the contract: Developed in accordance with:
R5	Documentation of the application of QA and QC activities to applicable project(s). Developed in accordance with:
NA	Programmatic QA Project Plan with supplements for each specific project, developed in accordance with:
Not Applicable	Existing documentation of the application of QA and QC activities will be used:

IV SIGNATURE BLOCK

The signatures below verify that the Statement of Work (SOW) has been reviewed to ascertain the necessary QA and QC activities required to comply with EPA Order 5360.1 A2, that the COR understands these requirements, and that the COR will ensure that the quality requirements indicated on the previous pages of this form are incorporated into all associated SOWs. *(Sign/date below, obtain a concurrence signature from the QA Staff, and submit the form along with the other extramural action documentation.)*

3/6/13			
Joe Wood NHSRC-DCMD Technical Lead Person	03/06/2013 Date	Ramona Sherman NHSRC-IO QA Staff Member	03/06/2013 Date

between samples is avoided.

4.8 The QAPP shall include a discussion of the procedures to be used to assure that representative samples are collected.

4.9 A list of sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis, shall be specified.

4.10 Containers used for sample collection, transport, and storage for each sample type shall be described.

4.11 Describe how samples are uniquely identified.

4.12 Sample preservation methods (*e.g.*, refrigeration, acidification, *etc.*), including specific reagents, equipment, and supplies required for sample preservation shall be described.

4.13 Holding time requirements shall be noted.

4.14 Procedures for packing and shipping samples shall be described.

4.15 Procedures to maintain chain_of_custody (*e.g.*, custody seals, records) during transfer from the field to the laboratory, in the laboratory, and among contractors and subcontractors shall be described to ensure that sample integrity is maintained.

4.16 Sample archival requirements for each relevant organization shall be provided.

SECTION 5.0, TESTING AND MEASUREMENT PROTOCOLS

5.1 Each measurement method to be used shall be described in detail or referenced. Modifications to EPA_approved or similarly validated methods shall be specified.

5.2 For unproven methods, verification data applicable to expected matrices shall be included in the QAPP meaning the QAPP shall provide evidence that the proposed method is capable of achieving the desired performance.

5.3 For measurements which require a calibrated system, the QAPP shall include specific calibration procedures applicable to each project target analyte, and the procedures for verifying both initial and continuing calibrations (including frequency and acceptance criteria, and corrective actions to be performed if acceptance criteria are not met).

SECTION 6.0, QA/QC CHECKS

6.1 At a minimum, the QAPP shall include quantitative acceptance criteria for QA objectives associated with accuracy, precision, detection limits, and completeness for critical measurements (process, physical, and analytical, as applicable) for each matrix.

6.2 Any additional project-specific QA objectives shall be presented, including acceptance criteria. This includes items such as mass balance requirements.

6.3 The specific procedures used to assess all identified QA objectives shall be fully described.

6.4 The QAPP shall list and define all other QC checks and/or procedures (*e.g.*, blanks, surrogates, controls, *etc.*) used for the project, both field and laboratory.

6.5 For each specified QC check or procedure, required frequencies, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met shall be included.

SECTION 7.0, DATA REPORTING, DATA REDUCTION, AND DATA VALIDATION

7.1 The reporting requirements (*e.g.*, units, reporting method [wet or dry]) for each measurement and matrix shall be identified.

7.2 The deliverables expected from each organization responsible for field and laboratory activities shall be listed.

7.3 Data reduction procedures specific to the project, and also specific to each organization, shall be summarized.

7.4 Data validation procedures specific to each organization used to ensure the reporting of accurate project data to internal and external clients shall be summarized.

7.5 Data storage requirements for each organization shall be provided.

7.6 The product document that will be prepared for the project shall be specified (*e.g.*, journal article, final report, *etc.*). The contents of this document can be referenced to a NHSRC or program-specific QMP, if appropriate.

SECTION 8.0, ASSESSMENTS

8.1 The QAPP shall identify all scheduled audits (*i.e.*, both technical system audits [TSAs] and performance evaluations [PEs]) to be performed, who will perform these audits, and who will receive the audit reports.

An applied research project is a study to demonstrate the performance of technologies under defined conditions. These studies are often pilot- or field-scale. The following requirements should be addressed as applicable.

SECTION 0.0, APPROVAL BY PROJECT PARTICIPANTS

The EPA Technical Lead Person (TLP) shall be responsible for obtaining signatures of appropriate project participants on the signature page of the QA plan, documenting agreement to project objectives and the approach for evaluating these objectives.

A distribution list shall be provided to facilitate the distribution of the most recent current version of the QAPP to all the principal project participants.

SECTION 1.0, PROJECT DESCRIPTION AND OBJECTIVES

1.1 The purpose of study shall be clearly stated.

1.2 The process, site, facility, and/or environmental system to be tested shall be described.

1.3 Project objectives shall be clearly stated and identified as primary or non-primary.

SECTION 2.0, PROJECT ORGANIZATION

2.1 Key points of contact for each organization involved in the project shall be identified.

2.2 All QA Managers and their relationship in the organizations (*i.e.*, location within each organization) shall be identified with evidence that the QA Manager is independent of project management.

2.3 Responsibilities of all other project participants and their relationship to other project participants shall be identified, meaning that organizations responsible for planning, coordination, sample collection, sample custody, measurements (*i.e.*, analytical, physical, and process), data reduction, data validation, and report preparation shall be clearly identified.

SECTION 3.0, EXPERIMENTAL APPROACH

3.1 The general approach and the test conditions for each experimental phase shall be provided. The statistical methods that will be used to evaluate the data (*i.e.*, ANOVA, or summary statistics) should be identified.

(NOTE: As deemed appropriate to the project by the TLP, the information requested in Sections 3.2, 3.3, and 3.4 may be presented here or in Section 4; the information requested in Sections 3.5 may be presented here or in Section 5; and the information requested in Sections 3.6 may be presented here or in Section 7.)

3.2 The sampling strategy shall be included and evidence must be presented to demonstrate that the strategy is appropriate for meeting primary project objectives, *i.e.*, a description of the statistical method or scientific rationale used to select sample sites and number of samples shall be provided.

3.3 Sampling/monitoring points for all measurements (*i.e.*, including locations and access points) shall be identified.

3.4 The frequency of sampling/monitoring events, as well as the numbers for each sample type and/or location shall be provided, including QC and reserve samples.

3.5 All measurements (*i.e.*, analytical [chemical, microbiological, assays], physical, and process) shall be identified for each sample type or process, and project-specific target analytes shall be listed and classified as critical or noncritical in the QAPP.

3.6 The planned approach (statistical and/or non-statistical) for evaluating project objectives shall be included.

SECTION 4.0, SAMPLING PROCEDURES

4.1 Whenever applicable, the method used to establish steady-state conditions shall be described.

4.2 Known site_specific factors that may affect sampling/monitoring procedures shall be described.

4.3 Any site preparation needed prior to sampling/monitoring shall be described.

4.4 Each sampling/monitoring procedure to be used shall be discussed or referenced. If compositing or splitting samples, those procedures shall be described.

4.5 For samples requiring a split sample for either QA/QC purposes or for shipment to a different laboratory, the QAPP shall identify who is responsible for splitting samples, and where the splitting is performed (*e.g.*, field versus lab).

4.6 If sampling/monitoring equipment is used to collect critical measurement data (*i.e.*, used to calculate the final concentration of a critical parameter), the QAPP shall describe how the sampling equipment is calibrated, the frequency at which it is calibrated, and the acceptance criteria for calibration or calibration verification, as appropriate.

4.7 If sampling/monitoring equipment is used to collect critical measurement data, the QAPP shall describe how cross-contamination

8.2 The QAPP shall provide procedures that are to be followed that will ensure that necessary corrective actions will be performed.

8.3 The responsible party(-ies) for implementing corrective actions shall be identified.

SECTION 9.0, REFERENCES

References shall be provided either in the body of the text as footnotes or in a separate section.

Attachment # 2

NHSRC QA
To the Statement of Work
Requirements/Definitions List

EPAs Quality System Website: http://www.epa.gov/quality
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html
EPA's Quality System Website: http://www.epa.gov/quality/qs-docs/r5-final.pdf

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) **a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;**
(2) **an organizational chart showing the position of the QA function;**
(3) **delineation of the authority and responsibilities of the QA function;**
(4) **the background and experience of the QA personnel who will be assigned to the project; and**
(5) **the organization's general approach for accomplishing the QA specifications in the SOW.**

NHSRC QA Requirements/Definitions List
Category Level Designations (determines the level of QA required):

☐ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP: QAPP** requirements for the specific project type (see below).

☐ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP QAPP** requirements for the specific project type (see below).

Project Types:

These outlines of NHSRC's QAPP Requirements for various project types, from Appendix B of the NHSRC QMP (except where otherwise noted), are condensed from typically applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These lists and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

☐ **Applied Research Project** - pertains to a study performed to generate data to demonstrate the performance of accepted processes or technologies under defined conditions. These studies are often pilot- or field-scale. The QAPP shall address all

requirements listed in "QAPP Requirements for Applied Research Projects" from Appendix B of the NHSRC QMP.

☐ **Basic Research Project** - pertains to a study performed to generate data used to evaluate unproven theories, processes, or technologies. These studies are often bench-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Basic Research Projects" from Appendix B of the NHSRC QMP.

☐ **Design, Construction, and/or Operation of Environmental Technology Project** - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" G-11, at http://www.epa.gov/quality/QS-docs/g11-final-05.pdf. For additional information, you may refer to Part C of "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology," ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995.

☐ **Geospatial Data Quality Assurance Project** - pertains to data collection; data processing and analysis; and data validation of geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" G-5S at http://www.epa.gov/quality/QS-docs/g5g-final-05.pdf.

☐ **Method Development Project** - pertains to situations where there is no existing standard method, or a standard method needs to be significantly modified for a specific application. The QAPP shall address all requirements listed in "QAPP Requirements for Method Development Projects" from Appendix B of the NHSRC QMP.

☐ **Model Development Project** - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" G-5M at http://www.epa.gov/quality/QS-docs/g5m-final.pdf.

☐ **Sampling and Analysis Project** - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information. The QAPP shall address all requirements listed in "QAPP Requirements for Sampling and Analysis Projects" from Appendix B of the NHSRC QMP.

☐ **Secondary Data Project** - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. The QAPP shall address all requirements listed in "QAPP Requirements for Secondary Data Projects" from Appendix B of the NHSRC QMP.

☐ **Software Development and Data Management Project** - pertains to software development, software/hardware systems development, database design and maintenance, data validation and verification systems. The QAPP shall address all requirements listed in "QAPP Requirements for Software Development Projects" from Appendix B of the NHSRC QMP.

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r2-final.pdf.

R-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r5-final.pdf.

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Technical Lead Person (TLP) - This person is technically responsible for the project. For extramural contract work, the TLP is typically the contracting officer's representative (COR). For intramural work, the TLP is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
NRMRL	National Risk Management Research Laboratory	QAM	Quality Assurance Manager
QA ID	Quality Assurance Identification	QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan	SOW	Statement of Work
QS	Quality System	CRADA	Cooperative Research & Development Agreement
TLP	Technical Lead Person		

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-58

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	THE IMPACT OF DECONTAMINATION

Contractor	Specify Section and paragraph of Contract SOW
ARCADIS U.S., INC.	Section 2

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:
THE IMPACT OF DECONTAMINATION TECHNOLOGIES (ETHYLENE OXIDE) ON MATERIALS AND EQUIPMENT

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period:	Cost/Fee:	LOE:
04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name Shannon Serre (Signature) (Date)		Branch/Mail Code: Phone Number 919-541-3817 FAX Number:
Project Officer Name Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name William Yates William Yates (Signature)	3/21/13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK

THE IMPACT OF DECONTAMINATION TECHNOLOGIES (ETHYLENE OXIDE) ON MATERIALS AND EQUIPMENT

DCMD C.2.3.2
(APPCD ON-SITE CONTRACT EP-C-09-027)

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

TABLE OF CONTENTS

I. TITLE

The Impact of Decontamination Technologies (Ethylene Oxide) on Materials and Equipment

II. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be from Award – 3/31/14.

III. SUMMARY OF OBJECTIVES

This work shall determine the impact of fumigation with ethylene oxide at sporicidal conditions on electronic equipment.

IV. RELEVANCE

Fumigation with ethylene oxide for the decontamination of certain materials and equipment contaminated with anthrax spores has been suggested as a safe alternative to more harsh fumigants such as chlorine dioxide or hydrogen peroxide. Unlike hydrogen peroxide and chlorine dioxide, ethylene oxide is not an oxidizing agent and kills organisms through alkylation. Information on the compatibility of materials and equipment with typical ethylene oxide fumigation conditions effective for anthrax spores has not been determined in a systematic, reproducible way. Future guidance on selection and operation of decontamination technologies is dependent upon such information.

V. BACKGROUND

Under Homeland Security Presidential Directive (HSPD) 10, the U.S. Department of Homeland Security (DHS) is tasked to coordinate with other appropriate Federal departments and agencies, to develop comprehensive plans which, "provide for seamless, coordinated Federal, state, local, and international responses to a biological attack." As part of these plans, the U.S. Environmental Protection Agency (EPA), in a coordinated effort with DHS, is responsible for "developing strategies, guidelines, and plans for decontamination of persons, equipment, and facilities" to mitigate the risks of contamination following a biological weapons attack.

EPA's National Homeland Security Research Center (NHSRC) provides expertise and products that can be widely used to prevent, prepare for, and recover from public health and environmental emergencies arising from terrorist threats and incidents. NHSRC's Decontamination and Consequence Management Division (DCMD)'s decontamination research program's goal is to provides expertise and guidance on the selection and implementation of decontamination methods and provide the scientific basis for a significant reduction in the time and cost of decontamination events.

Past field experience and recent laboratory investigation have shown the effectiveness of several decontamination technologies for use against anthrax spores and other biological agents. The effectiveness of the technologies varies significantly as a function of operating conditions and challenge conditions (e.g., materials intended to be decontaminated). The use of chlorine dioxide (ClO_2) gas, fumigant hydrogen peroxide (H_2O_2), and methyl bromide has been shown to be effective in the field and laboratory when used in the appropriate circumstances. In addition to efficacy, the development of the remediation strategy also includes consideration of the ability to achieve effective conditions (e.g., fumigant concentration) within the application scenario and the impact of the decontamination process on materials and equipment.

It is not anticipated that another equipment analysis contract will be completed to provide material analysis capabilities. Only PC Doctor will be used to characterize the effect of ethylene oxide on the equipment.

VI. SCOPE

The purpose of this study is to determine the impact of ethylene oxide fumigation on relevant materials and equipment at decontamination conditions required for sporicidal kill in public facilities. This Statement of Work (SOW) covers the implementation of the treatment test matrix, the protocol for initial diagnostics, the comprehensive analysis of the treated equipment, and the reporting of the findings.

VII. TECHNICAL APPROACH

The contractor, upon approval from the EPA WAM, shall procure all test equipment and materials to be included in the test sets. The computers were procured during WA 2-58 and no further computer purchases are anticipated. The test equipment and materials are considered expendable items in this project. The contractor shall conduct pre-screening and documentation of all test equipment and materials prior to exposure to the fumigation conditions in accordance with the approved Quality Assurance Project Plan (QAPP). The equipment shall be exposed to ethylene oxide by the contractor according to the finalized test matrix. The contractor shall then re-run the diagnostic protocol on fumigated computers and assess the impact on the other equipment and materials per the protocols. The contractor shall provide all data to the EPA WAM within one week following the fumigation test and within one week after completing diagnostic analysis on each computer system. All material and equipment shall be evaluated per the appropriate protocol (as documented in the approved QAPP) monthly for a period of 1 year following the fumigation date.

VIII. AFFORDABILITY

The contractor shall procure all test materials/equipment. The ethylene oxide chamber will be provided by the EPA and is not included as part of this WA. The computer equipment was purchased in WA 2-58, no further computer purchases are anticipated.

IX. TECHNICAL RISK

The technical risk involved in this project is minimal. The ultimate goal in Task 3 is to determine the effect of the ethylene oxide fumigation on electronic equipment. The null and alternative hypotheses are expected to be easily determined and verified.

X. FACILITIES AND MATERIALS

All experimental efforts shall be performed by the contractor at the U.S. EPA's Decontamination Technologies Research Laboratory (DTRL) located on the U.S. EPA campus in Research Triangle Park, NC. The ethylene oxide chamber will be provided by the EPA and is not included as part of this WA.

XI. TASKS

The work to complete the tasks listed below shall be conducted in the NHSRC/DCMD's Decontamination Technologies Research Laboratories (DTRL) located on EPA's Research Triangle Park, NC campus. The deliverable dates and availability of vendor-supplied equipment shall be used by the contractor work assignment leader (WAL), in consultation with the EPA WAM, to determine the testing schedules.

The assessment of the impacts on three categories of items separated according to the analysis requirements shall be completed. The first category of materials (Category 2; there is no Category 1 for this SOW, but the numbering is maintained from previous efforts for consistency) includes materials that will be of typically low surface area within a building, but their functionality may be impacted by the fumigant or fumigation process. Analysis of the items in this category include visual inspection, surface analysis on selected samples (e.g., SEM), and standard methods for such materials as used within buildings (e.g., conductivity testing). The third category of materials (Category 3) includes small, personal electronic equipment and electrical circuits. The analysis shall be limited to functionality testing and visual inspection. The fourth category of materials (Category 4) includes computers and monitors. The primary focus for Category 4 materials is on the impact of the fumigant on the functionality of the equipment (material compatibility).

The following tasks are defined as part of this work assignment:

Task 1 – Revision of the QAPP/Test Plan

A draft Test/QAPP has been written for this project. The Revised Test Plan shall include the material compatibility testing (exposure and analysis) for Category 2, 3, and 4 materials for testing with ethylene oxide. The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this work assignment (see Attachment #1 to the SOW) and the NHSRC QA requirement as defined in Attachment #2 to the

SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

Task 2 - Determination of Test Equipment, Materials and Test Matrix

NHSRC is interested in the effects of decontamination processes for biological agents on electronic equipment. The fumigant of interest for this effort is ethylene oxide. The test materials and equipment for this effort shall include those items listed in Table 1 for Category 2 materials and Table 2 for Category 3 materials. Category 4 Equipment shall include desktop computers and monitors consistent with those used in previous material compatibility projects, these items are a Dell OptiPlex 780 Desktop Computer (or equivalent), a Dell 15 inch Flat Panel Monitor, a USB keyboard and mouse, and a computer and monitor power cords and connecting analog video cable (SVGA). The computers have already been purchased for this work assignment. All materials and equipment required for this testing shall be procured by the contractor as expendable test materials. Additional materials and equipment may be added to this list by the EPA WAM provided that it is within the available level of effort for the project or additional funding is provided via amendment of this work assignment. All materials and equipment shall be fumigated in triplicate at each test condition.

Table 1: Category 2 Materials

Material	Description	Supplier/ Manufacturer	Part Number	Coupon/ Sample Size
Type 3003 Aluminum	Textured 0.0625 inch thick sheet	McMaster Carr	88685K12	2" x 2", 3 pieces
Alloy 101 Copper	0.064" thick polished electrical grade, 99.99% pure	McMaster Carr	3350K19	2" x 2", 3 pieces
Low Carbon Steel	Un-milled 0.0625" thick	McMaster Carr	6615K29	1 ½" x 2" , 3 pieces
Type 316 Stainless Steel	0.0625" thick 2B finish	McMaster Carr	9090K11	2" x 2" , 3 pieces
Type 304 Stainless Steel	0.0625" thick #3 finish	McMaster Carr	9085K11	2" x 2" , 3 pieces
Type 410 Stainless Steel	0.0625 " thick	McMaster Carr	9524K62	2" x 2" , 3 pieces
Type 430 Stainless Steel	0.012" thick unpolished	McMaster Carr	8457K43	1" x 2" , 3 pieces
Type 309 Stainless Steel	0.0625" thick	McMaster Carr	9205K151	1 ½" x 2" , 3 pieces
DSL Line Conditioner	Phone and DSL connectors embedded within	McMaster Carr	1522T23	1 piece
Incandescent Light	With electrical switch	McMaster Carr	1627K48	1 piece
Steel Outlet/Switch Box	2" x 3 " x 1 ½ "	McMaster Carr	71695K81	1 piece
Silicone Caulk	Applied to switch box to test sealing capacity	McMaster Carr	7582T15	1" x 1"
Type 3003 Aluminum	Textured 0.0625 inch thick sheet	McMaster Carr	88685K12	2" x 2", 3 pieces
Yellow SJTO 300 VAC Service cord	16/3 AWG, .33" OD	McMaster Carr	8169K39	3 pieces
Smoke Detector	Battery-powered Ionization	First Alert	SA304	1 piece

Material	Description	Supplier/ Manufacturer	Part Number	Coupon/ Sample Size
	sensor with battery			
Laser printed paper	Stack of 15 pages (first 15 pages of this QAPP)	RTO-E340-PS HP Color LaserJet	NA	8 ½" x 11"
Ink jet colored paper	Stack of 15 pages (test page used in previous work)	HP DeskJet 932C	NA	8 ½" x 11"
Color Photograph	4" x 6" Kodak processing	Walgreens	NA	4" x 6", 3 pieces
Static Intercept bags	20" x 24" x 0.003" bags	Dasal Technical products	NA	1 piece
ABS plastic	0.125" thick	McMaster Carr	8586K101	1½" x 2", 3 pieces
High density polyethylene plastic film	4 mil HDPE stretched across PVC tube	McMaster Carr	8552K81	2" x 4", 3 pieces
Low density polyethylene plastic film	4 mil LDPE stretched across PVC tube	McMaster Carr	8553K814	2" x 4", 3 pieces
Duct tape	2" wide Premium Duty, Fed. Spec. PPP-T-60E, Type IV, Class I. Used to seal plastic films onto PVC tube	McMaster Carr	7612A7	12" long circumference, 6 pieces
PVC plastic	2" x 4" rectangular tube, 0.098" wall	McMaster Carr	85095K95	1" length, 3 pieces

Table 2: Category 3 Materials and Equipment

Equipment	Description	Manufacturer	Model Number	Sample Size
Personal Digital Assistant (PDA)	Handheld	Palm	Z22	1 piece
Cell Phone	Pay as you go Super thin flip super phonic ring tones full color screen	Virgin (Kyocera)	Marbl	1 piece
Fax/Phone/ Copier Machine	Plain-paper fax and copier with 10-page auto document feeder and up to 50-sheet paper capacity. 512KB memory stores up to 25 pages for out-of-paper fax reception	Brother	Fax 575	1 piece
Data CD	Software CD	Snap!	01-0170-026-000	1 piece
Data DVD	Standard 21331 DVD Video	Warner Brothers	Harry Potter And the Sorcerer's Stone DVD	1 piece

The contractor shall provide technical support to the EPA WAM in the final decision on the material/equipment to be included based upon an understanding of the objectives of the study and the physical properties/behavior of the fumigant.

The test matrix is shown in Table 3. In Test 2, computer system test set shall be fumigated individually. Thus, three fumigation cycles (or runs) will be required to complete Test 2 (fumigate all 3 computer system test sets). Because of the explosive nature of ethylene oxide all systems shall

be fumigated in the off state with all internal batteries removed. No other use of the ethylene oxide system shall be done while these tests are being conducted.

Table 3A: Test Matrix for Category 2 and 3 Materials/Equipment

Test Condition	Equipment Power State During Fumigation	Treatment Conditions
1	Off	Ethylene Oxide: RH, T=122 °F, and other conditions to be determined
2	Off	No Ethylene Oxide: same time, humidity and temperature in Test 1

Table 3B: Test Matrix for Category 4 Materials/Equipment

Test Condition	Equipment Power State During Fumigation	Treatment Conditions
1	Off	Ethylene Oxide: RH, T=122 °F, and other conditions to be determined
2	Off	Ethylene Oxide: RH, T=122 °F, and other conditions to be determined
3	Off	Ethylene Oxide: RH, T=122 °F, and other conditions to be determined
4	Off	No Ethylene Oxide: same time, humidity and T=122 °F in Tests 1-3
5	ON and Idle	Standard fumigation conditions (3000 ppmv ClO_2, 75 % RH, 75 °F, 3 hrs)

Task 3 – Conducting the Compatibility Testing

The contractor shall conduct the testing described in the QAPP that was revised as part of Task 1. This shall include running diagnostic testing on all equipment, including running the PC Doctor protocol on all computer systems. The PC Doctor protocol shall be developed by the contractor. Digital photographs and documentation of the appearance or relevant properties, consistent with those defined in the QAPP, shall be made prior to exposure of the equipment/materials to the test conditions. The contractor shall assemble the necessary fumigation equipment to conduct the treatments. The equipment/materials shall be treated in accordance with the finalized test matrix to be included in the QAPP. After exposure, the assessment of the impact of the fumigation on the equipment/materials shall be performed. The assessment shall include complete documentation and digital photographs of all items. For computer systems, the PC Doctor diagnostic protocol shall be run post-exposure to the fumigation conditions. All assessments, including PC Doctor, shall be made monthly for up to one year following the fumigation event.

Biological indicators shall be added to each sterilization cycle and analyzed by the APPCD microbiology laboratory. Temperature and RH shall be monitored inside each bag during each sterilization cycle.

Residual off-gasing from the materials and equipment may also be investigated after exposure to ethylene oxide. It is anticipated that this work may be done by EPA's Emergency Response Team (ERT) using one of their gas chromatographs. The contractor shall be required to provide the

exposed computers to ERT by placing in the stainless steel chambers that were developed in WA 1-58.

The contractor shall develop the health and safety research protocol (HSRP) for this work and obtain approval from the contractor and U.S. EPA health and safety officers prior to commencement of any studies with ethylene oxide. Any accidents, incidents, or deviations from standard operating procedures shall be reported to the EPA WAM in writing within 24 hours of such incident.

Task 4 – Reporting
All data collected per the QAPP shall be submitted to the EPA WAM within one week after the completion of the analysis. Submission shall be via posting on the NHSRC share drive and by hard copy to the WAM.

Bi-weekly meetings shall be scheduled between the contractor WAL and the EPA WAM to discuss relevant results.

The contractor shall submit a draft report on the compilation of results to date from the equipment compatibility testing by 2/28/14. The report shall include photographic and graphical documentation, where appropriate, to support the findings. The report shall be provided in both hardcopy and electronic (MS Word) format.

Task 5 – Material Demand and Efficacy Testing
After the compatibility tests have been conducted in Task 3, the WAM shall determine whether efficacy testing is required to determine if the Andersen system achieves sporicidal conditions during a test cycle. This task may involve material demand measurements where representative materials are exposed to ethylene oxide to determine if the ethylene oxide absorbs or reacts with the material thus reducing the concentration in the chamber. Efficacy testing in this project would utilize *Bacillus atrophaeus* or another appropriate surrogate for *Bacillus anthracis*. If the WAM decides to pursue material demand and efficacy testing the contractor shall follow the QAPP/Test Plan that was generated as part of WA 2-58. Any tests outside of the previously approved QAPP will require an amendment to the QAPP.

Task 6 – Revision of Material Effects of Fumigants on Irreplaceable Objects Report
The contractor shall provide assistance in revising the report on the results from the material effects of fumigants on irreplaceable objects. The report shall be provided in both hardcopy and electronic (MS Word) format.

XII. DELIVERABLE SCHEDULE

- On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, quarterly and cumulative financial expenditures and cost and schedule variance.
- A draft report shall be delivered to the EPA WAM by 2/28/14.

Table 4: Deliverable Schedule

Deliverable	Date
Revised QAPP/Test Plan	1 month after WA award
Data summaries	On-going
Draft Report Material Compatibility with EtO	2/28/14
Draft Report on Material Demand and Efficacy with EtO	2/28/14

XIII. REPORTING REQUIREMENTS

- The Contractor shall prepare Quality Control data reports of all facility-specific data. Each Quality Control report shall be in a format suitable for EPA/NHSRC publication and shall discuss how well various measurements described in the QA plan were met.
- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.
- In lieu of a final technical report, journal papers within each task may be submitted at the discretion of the EPA WAM. The papers shall be authored or co-authored by the EPA WAM, at the discretion of the WAM. To serve in lieu of the final report, the journal articles must contain all of the relevant information that would have appeared in the final report.
- All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-59

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Evaluation of Bio Agent Decont

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Shannon Serre (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3817 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature)	10-22-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK

EVALUATION OF BIO AGENT DECONTAMINATION OPTIONS FOR OWNER/OCCUPANTS

C.2.2.1.3
(APPCD ON-SITE CONTRACT EP-C-09-027, WA 4-59)

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

TABLE OF CONTENTS

I. TITLE
Evaluation of Bio Agent Decontamination Options for Owner/Occupants

II. PERIOD OF PERFORMANCE
The period of performance for the work under this work assignment shall be Award – 3/31/14.

III. SUMMARY OF OBJECTIVES
This work shall examine self help biological agent decontamination options for homeowners or building occupants. These are options that can utilize materials that are commonly available to the homeowner. Another objective is to develop a test plan for testing and evaluation sporicidal gels and foams.

IV. RELEVANCE
This project is focused on self decontamination that a home owner could perform in a home that has low level biological contamination. This scenario would involve a person that was unknowingly exposed *to B. anthracis* spores and brought the spores into their home.

V. BACKGROUND
Under Homeland Security Presidential Directive (HSPD) 10, the U.S. Department of Homeland Security (DHS) is tasked to coordinate with other appropriate Federal departments and agencies, to develop comprehensive plans which, "provide for seamless, coordinated Federal, state, local, and international responses to a biological attack." As part of these plans, the U.S. Environmental Protection Agency (EPA), in a coordinated effort with DHS, is responsible for "developing strategies, guidelines, and plans for decontamination of persons, equipment, and facilities" to mitigate the risks of contamination following a biological weapons attack.

EPA's National Homeland Security Research Center (NHSRC) provides expertise and products that can be widely used to prevent, prepare for, and recover from public health and environmental emergencies arising from terrorist threats and incidents. NHSRC's Decontamination and Consequence Management Division (DCMD)'s decontamination research program's goal is to provides expertise and guidance on the selection and implementation of decontamination methods and provide the scientific basis for a significant reduction in the time and cost of decontamination events.

VI. SCOPE
The primary objective of this project is to examine methods that a homeowner could use to inactive a low level concentration of *B. anthracis* spores on non-porous surfaces. Since bleach is commonly available in most homes the project will begin by examining the efficacy of diluted bleach for the inactivation of biological spores.

A secondary objective is to develop a test plan that can be used for evaluating the sporicidal properties of gels and foams. A variety of coupons will be provided that can be decontaminated by using a strippable gel or foam. These would be decontaminated in the spray chamber. Subsequent, pending efficacy, larger scale testing in COMMANDER could be done in an environment agreed upon by the project team (i.e.,subway walls or an office environment).

VII. TECHNICAL APPROACH
The contractor, upon approval from the EPA WAM, shall procure all test equipment and materials to be included in the test sets. The procedure would utilize household bleach at a given dilution ratio to inactivate spores on a non-porous surface. An approach may involve the scenario listed below utilizing a wash and a rinse bucket. The first bucket would contain the diluted bleach and the second bucket would contain rinse water. A clean sponge or cloth rag would be wetted in the diluted bleach solution and used to wipe down the surface. The surface would be kept wet for a given amount of time (x minutes). Following the given contact time, a rinse step would be initiated by taking a separate rag and wetting in the clean rinse water bucket. The surface would be rinsed with the rinse rag to remove the bleach solution. Following the decontamination steps the surface would be sampled to determine the efficacy of this approach.

VIII. AFFORDABILITY

This effort is labor intensive, which is where the bulk of the funding is required. The contractor shall procure all test materials/equipment. The gels and foams will be provided by the vendor or purchased by the EPA.

IX. TECHNICAL RISK

The technical risk involved in this project is minimal. The ultimate goal is to test and evaluate diluted bleach on a variety of materials to evaluate the efficacy against biological spores.

X. FACILITIES AND MATERIALS

All experimental efforts shall be performed by the contractor at the U.S. EPA's Decontamination Technologies Research Laboratory (DTRL) located on the U.S. EPA campus in Research Triangle Park, NC.

XI. TASKS

The work to complete the tasks listed below shall be conducted in the NHSRC/DCMD's Decontamination Technologies Research Laboratories (DTRL) located on EPA's Research Triangle Park, NC campus. The deliverable dates and availability of vendor-supplied equipment shall be used by the contractor work assignment leader (WAL), in consultation with the EPA WAM, to determine the testing schedules.

The following tasks are defined as part of this work assignment:

Task 1 – Preparation of Work Assignment Work Plan
A detailed Work Plan is due 20 calendar days after receipt of the approved Work Assignment. Content shall be in accordance with terms and conditions of the contract.

Task 2 – Development of a QAPP/Test Plan for the Parametric Bleach Testing
A draft Test/QAPP shall be developed for the parametric bleach testing portion of this project. The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this work assignment (see Attachment #1 to the SOW) and the NHSRC QA requirement as defined in Attachment #2 to the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

For this Task, household bleach (sodium hypochlorite 5-6%) shall be diluted at ratios starting at 10:1 and working down to a 1:1 ratio if necessary. If a 10:1 ratio is effective at inactivating the spores on a given material then the dilution ratio shall be increased. Testing shall begin with a wetted contact time of 10 minutes.

Materials of interest include glass, painted wallboard, finished wood flooring, ceramic tile, stainless steel, plastic, and formica/laminate countertop. The coupons shall be 14" by 14" and contaminated with a10^6 CFUs/coupon.

Variables
-Bleach dilution ratio
-Addition of a commercially available surfactant
-Contact time
-Sponge or rag application
-Addition of grime/organic matter

Task 3 – Development of a QAPP/Test Plan for the Gel and Foam Testing
A draft Test/QAPP shall be developed for the parametric bleach testing portion of this project. The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this work assignment (see Attachment #1 to the SOW)

and the NHSRC QA requirement as defined in Attachment #2 to the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

For this task, EPA provided gels and or foams shall be tested for their ability to inactivate biological spores. Spores will be deposited on 14" x 14" coupons using the dry deposition method. The gel and/or foam shall be applied according to the manufacturer's directions. Biological samples will be collected before and after application to evaluate the efficacy. It is anticipated that EPA response personnel will perform the application of the gel and foam and collect the biological samples. The samples will be analyzed in the EPA's microbiology laboratory.

Materials of interest include: glass, carbon steel, carpet, concrete, Formica, and wooden deck boards. Coupons will be limited to 1-2 porous and 1-2 non-porous.

Task 4 –Efficacy Testing of the Parametric Bleach Testing
Efficacy testing following the approved QAPP/Test Plan shall be conducted utilizing *Bacillus atrophaeus* or another appropriate surrogate for *Bacillus anthracis*. No data collection shall begin until the QAPP is approved.

Task 5 – Reporting
All data collected per the QAPP shall be submitted to the EPA WAM within one week after the completion of the analysis. Submission shall be via posting on the NHSRC share drive. This shall include copies of log books and all relevant electronic files.

The contractor shall submit a draft report on the compilation of results from the parametric bleach testing by 2/15/14. The report shall include photographic and graphical documentation, where appropriate, to support the findings. The report shall be provided in both hardcopy and electronic (MS Word) format.

XII. DELIVERABLE SCHEDULE

- On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, quarterly and cumulative financial expenditures and cost and schedule variance.
- A draft report on the parametric bleach testing shall be delivered to the EPA WAM by 2/15/14.

Table 1: Deliverable Schedule

Deliverable	Date
QAPP/Test Plan for Parametric Bleach Testing	3 weeks after WA award
QAPP/Test Plan for Gel/Foam Testing	3 weeks after WA award
Data summaries	On-going
Draft Report on Parametric Bleach Testing	2/15/14

XIII. REPORTING REQUIREMENTS

- The Contractor shall prepare Quality Control data reports of all facility-specific data. Each Quality Control report shall be in a format suitable for EPA/NHSRC publication and shall discuss how well various measurements described in the QA plan were met.
- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.
- In lieu of a final technical report, journal papers within each task may be submitted at the discretion of the EPA WAM. The papers shall be authored or co-authored by the EPA WAM, at the discretion of the WAM. To serve in lieu of the final report, the journal articles must contain all of the relevant information that would have appeared in the final report.

- All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

NHSRC QUALITY ASSURANCE REQUIREMENTS FORM
Attachment 1 to the Statement of Work

I GENERAL INFORMATION

Title:	Evaluation of Bio Agent Decontamination Options for Owner/Occupants
Description:	Evaluation of Bio Agent Decontamination Options for Owner/Occupants
Project ID:	C.2.2.1.3
Status:	Original
Number Ammended:	
QA Category:	III
Action Type:	Extramural
Peer Review Category:	III
Security Classification:	Unclassified
Project Type:	Applied Research
QAPP Status 1:	Not Delivered
Vehicle Status:	Existing Vehicle
Vehicle Type:	Vehicle Number: EP-C-09-027 Work Assignment Number: 4-59 Delivery/Task Order Number: NA Modification Number: NA Other: NA

*If you are processing an **IAG** or **CRADA**, the responsibility for QA must be negotiated within the agreement. The TLPs in consultation with the QAMs in the various organizations must agree on, and document, which organization will take the lead for QA, the names of the QAM and TLP from each organization, and the QA requirements that will be adhered to during the agreement. Include this info in the IAG/CRADA package.*

II SCOPE OF WORK

Yes — Does the Statement of Work contain the appropriate QA language?

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with the R-2 and R-5 and/or the attachments provided with the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf

Yes — Does this extramural action involve the collection, generation, use, and/or reporting of environmental data; the design, construction, and operation of environmental technologies; or development of software, models, or methods?
(If "No" then skip to Section IV, and sign the form.)

No — Will the SOW or any subsequent work assignments or task orders involve any cross-organizational efforts within EPA?

No — Has a QAPP already been approved for the activities specified in the SOW?

No — Is an applicable QAPP in the process of being prepared, revised, or approved by EPA personnel for future use

by the contractor? (QA approval must be obtained before the contractor can start work.)

III QA DOCUMENTATION OPTIONS

All documentation specified under "Other" must be defined in the NHSRC Quality Management Plan and be consistent with requirements defined in EPA Manual 5360 A1. For all items checked below, there must be adequate information in the SOW (or its appendices) for the offeror to develop this documentation. Where applicable, reference a specific section of the SOW. *(R-2 refers to EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, 03/20/01) and R-5 refers to EPA Requirements for Quality Assurance Project Plans (QA/R-5) (EPA/240/B-01/003, 03/20/01). Copies of these documents are available at http://www.epa.gov/quality/qa_docs.html.)*

After Award Documentation

Not Applicable	Documentation of an organization's Quality System. QMP developed in accordance with:
Not Applicable	Combined documentation of an organization's Quality System and application of QA and QC to the single project covered by the contract: Developed in accordance with:
Other	Documentation of the application of QA and QC activities to applicable project(s). Developed in accordance with:
	Explain: The QAPPs shall be developed in accordance with the attachment #1 (QAPP requirements for applied research projects)
n/a	Programmatic QA Project Plan with supplements for each specific project, developed in accordance with:
Not Applicable	Existing documentation of the application of QA and QC activities will be used:

IV SIGNATURE BLOCK

The signatures below verify that the Statement of Work (SOW) has been reviewed to ascertain the necessary QA and QC activities required to comply with EPA Order 5360.1 A2, that the COR understands these requirements, and that the COR will ensure that the quality requirements indicated on the previous pages of this form are incorporated into all associated SOWs. *(Sign/date below, obtain a concurrence signature from the QA Staff, and submit the form along with the other extramural action documentation.)*

Shannon Serre NHSRC-IO Technical Lead Person	09/13/2013 Date	Ramona Sherman NHSRC-IO QA Staff Member	09/16/2013 Date

QAPP REQUIREMENTS FOR APPLIED RESEARCH PROJECTS

(from Appendix B of the NHSRC QMP)

An applied research project is a study to demonstrate the performance of technologies under defined conditions. These studies are often pilot- or field-scale. The following requirements should be addressed as applicable

SECTION 0.0, APPROVAL BY PROJECT PARTICIPANTS

The EPA Technical Lead Person (TLP) shall be responsible for obtaining signatures of appropriate project participants on the signature page of the QA plan, documenting agreement to project objectives and the approach for evaluating these objectives

A distribution list shall be provided to facilitate the distribution of the most recent current version of the QAPP to all the principal project participants.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-62

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	DCMD Metrology QA Laboratory S

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Scott Moore (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-5104 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates (Signature) (Date)	3-27-13	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

SOW FY 2013-2014
Period of Performance: 04/01/2013 – 03/31/2014
Work Assignment Manager (WAM): Scott A, Moore
Work Assignment Title: DCMD Metrology QA Laboratory Support
Contract Number: EP-C-09-027
Work Assignment Number: 4-62

Introduction

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To ensure good QA it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to assure that it produces reliable data. The Decontamination and Consequence Management Division (DCMD) of the National Homeland Security Research Center requires that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (MetLab) provides QA assistance to DCMD researchers by providing the procedures and the standards to calibrate various scientific devices.

I. Goal/Purpose

The objective of this Work Assignment (WA) is to provide MetLab support to DCMD. The MetLab is a facility with the capabilities to check (or audit) the calibration of Environmental Protection Agency (EPA) measurement instrumentation. A second objective is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to assure and document that operations performed in EPA facilities produce data of a known and adequate quality. This work assignment does not pertain to the calibration of facility devices such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons because these are not used to produce data for EPA research products.

II. Background Information

Data Uses — Primary users of the products of this WA will be researchers and operators of equipment in EPA facilities. Calibration and PEA results can be reported in research reports to support or verify findings.

Lab Site — Work area is D360-A, D362, and D364-A in EPA's Research Center in Research Triangle Park, NC.

Experience — Personnel assigned to this WA must be capable of performing the tasks listed in Section III (Tasks), which include electrical work, plumbing, general experience with lab equipment and materials, a familiarity with the calibration of measurement devices, and a fundamental understanding of the principals behind the measurements and

the ability to reduce data and report it according to the International Organization for Standardization ISO 17025 "General Requirements for the Competence of Calibration and Testing Laboratories" (ISO 17025) and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

III. Tasks

Task 1. Metrology Quality Assurance Laboratory Support for DCMD

Sub-Task A. Lab Equipment and Supplies

(1) The Contractor shall obtain performance specifications on potential calibration equipment. The Contractor shall maintain and upgrade calibration systems and equipment as needed. Final decisions regarding upgrading and replacing equipment will be relayed to the Contractor in a technical directive through the WAM.

(2) The Contractor shall maintain MetLab equipment in proper working order. The Contractor shall identify calibration needs and ensure that the necessary factory equipment calibrations for the MetLab equipment are kept up to date. The Contractor shall maintain a record of all maintenance activities. Whenever practically possible the calibration data for this equipment shall include National Institute of Standards and Technology (NIST) traceable information.

(3) The Contractor shall give monthly reports on all charges associated with Sub-Tasks

Sub-Task B. MetLab Operations

(1) The Contractor shall perform measurement device and equipment calibrations that conform to ISO 17025 and the GUM. The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WAM shall be notified and then provide technical direction to the contractor for prioritization. The Contractor shall maintain a record and data base of all equipment calibrations and calibration schedules.

(2) The Contractor shall develop, document, and implement detailed calibration operating procedures for all laboratory calibration services.

(3) The Contractor shall assemble and maintain a system of published procedures and product information relevant to calibration measurement procedures and measurement devices.

(4) The Contractor shall develop a Standard Operating Procedure (SOP) for scheduling calibration of EPA equipment. This SOP will include identifying whether the device is in

use, and if it is in need of calibration relaying that information the Facility Manager, Principle Investigator (PI) or the Technical Lead of the project using the device.

(5) The Contractor shall give monthly reports on all charges associated with Sub-Task B.

Sub-Task C. Validation of Procedures and Calibration Tracking System

The Contractor shall confirm the current acceptable validation methods for all calibration systems used in the MetLab and also for the calibration tracking system. Any confirmation of validation methods should be documented. All database functions that are user-programmed shall be tested and the validation documented. Each revision to the database software (exclusive of the data in the database) shall have an identifiable revision number assigned to it. The Contractor shall give monthly reports on all charges associated with Sub-Task C.

IV. Deliverables (Applies to all Tasks)

The Contractor shall provide the following reports:

(1) Monthly reports of the laboratory support activities including the following:
   a) The number of and type of calibrations performed.
   b) Any costs incurred during calibration activities.
   c) Any maintenance activities performed.
   d) Any documentation activities performed.
   e) Status of the Facility Manuals.
   f) Any other activities that would impact the operation of the MetLab.

(2) Special reports as requested via a Technical Directive by the WAM

(3) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WAM shall be notified and then provide technical direction to the contractor for prioritization.

(4) The WAM shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WAM.

(5) The contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(6) Formatting of reports should be comparable to historical reporting and electronic files should be compatible with Agency Standard Software, such as MS Excel 2007, MS Word 2007 and Adobe Reader 9.0 or current agency standard software. Hard copies of reports are acceptable; however, electronic copies are encouraged.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-63

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base X Option Period Number	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

[ ] Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Thomas Long (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3944 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 6-21-13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Performance Work Statement
Contract EP-C-09-027
Work Assignment 4-63

Title

Biodiesel Speciated Fuel and Temperature Effects in Heavy-duty Diesel Truck Engines (Class 6 Heavy-Duty Diesel Engine)

Description

Generate emissions data from one Class 6 Heavy Duty Diesel Engine (per the Emission Standards Reference Guide for Heavy-Duty and Nonroad Engines). Driving cycles will consist of one Heavy-Duty Urban Dynamometer Driving Schedule (http://www.epa.gov/otaq/emisslab/methods/huddscol.txt) and two California Air Resources Board Medium Heavy Duty Low Speed Transient Cycles.

Background

This project directly addresses the air, climate, and human health program areas, and supports the other motor vehicle as well as the biodiesel biofuels initiative projects. The 2007 Diesel Highway Rule (40 CFR Parts 69, 80, and 86), phased in new emissions standards requiring 100% compliance in 2010. While the two currently regulated "critical pollutants", particulate matter (0.01 grams per brake-horsepower-hour (g/bhp-hr)) and NO_x (0.20 g/bhp-hr) impact air quality and related health issues, proposed new rules focus on two related areas with broader environmental and social effects: truck fuel economy and greenhouse gas (GHG) emissions. The two go hand-in-hand because burning carbon-based petroleum fuels creates carbon emissions, so improving fuel economy directly lowers an internal combustion engine's main GHG, carbon dioxide (CO_2).

Scheduled to be phased in between 2014 and 2018, new truck rules are part of an overall energy strategy that looks to reduce U.S. dependency on foreign energy supplies and lower CO_2 creation to address global warming concerns. It is estimated that commercial trucks consume more than 2-million barrels of oil every day and account for 20% of transportation-related GHGs. For example, the state of California estimates that diesel trucks are responsible for seven and a half percent of all of California's global warming pollution.

The call for truck rules does not come with specific target numbers, but requires EPA, with the aid of the National Highway Transportation Safety Administration (NHTSA) to set standards based on research data. Much of the guidance for determining the standards will come from a congressionally mandated report. Created under the auspices of the National Research Council (NRC), "Technologies and Approaches Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles" was put together by a 19-member panel that combined academic researchers, engineers, and technologists with backgrounds in truck and component manufacturing.

Diesel PM consists of three primary constituents: elemental carbon particles from incomplete combustion, which make up the largest portion of the total PM; the soluble organic fraction (SOF), which consists of unburned hydrocarbons that have condensed into liquid droplets or have adsorbed onto the surfaces of the elemental carbon particles; and sulfates with associated water, which result from oxidation of fuel-borne sulfur in the engine's exhaust.

Several exhaust emission control devices have been developed to control diesel PM constituents – the diesel oxidation catalyst (DOC), and the many forms of PM filters, catalyzed diesel particulate filters (CDPFs), or PM traps. DOCs have been shown to be durable in use, but they effectively control only the soluble organic fraction (SOF) portion of the total PM which, especially on today's engines, constitutes only around 10 to 30 percent of the total PM. Therefore, the DOC alone is not capable of meeting the FTP 0.01 g/bhp-hr PM standard set in the 2007 Diesel Highway Rule.

This study will focus on the effects to emissions from the use of biodiesel blend (B20 – ASTM D7467) fuel in on-road vehicles. The use of biodiesel in fuel has increased nearly three-fold since 2005, according to the National Biodiesel Board. The use of biodiesel increases the minimum usable (cloud point, pour point, and cold filter plugging point) temperature by as much as 10 degrees Fahrenheit without the use of additives. Cold temperature testing will take place at 20 degrees Fahrenheit.

For these reasons, this study will focus on the use of B20 in vehicles fitted with diesel particulate traps to mitigate the emission of elemental carbon particles. The baseline fuel will be ultra-low-sulfur diesel fuel (ULSD) conforming to 40 *Code of Federal Regulations* 86.1313-2007.

The US EPA Heavy-Duty Highway Rule applies to vehicles manufactured in 2007 and beyond. It also limits fuel to less than 15 ppm of sulfur. While heavy-duty vehicles only make up $1/10^{th}$ the VOC emissions of light-duty vehicles and roughly 6% of the CO emissions, they contribute nearly the same amount of NO_x, and 1.5 times the $PM_{2.5}$. Hydrocarbon (HC) emissions are composed of hundreds of compounds, some of which have been identified by the EPA as air toxics. The Clean Air Act directs EPA to set standards to reduce air toxics emissions. For this reason, both regulated emissions and a subset of speciated emissions will be measured and reported.

For heavy-duty diesel engines of model year 2010 and later, certification testing is to be performed in conformance with 40 CFR 1065. This study will use vehicles of MY 2010 or later and therefore testing will conform to 40 CFR 1065 (exceptions to be noted in the Quality Assurance Project Plan).

Scope and Objectives

This Work Assignment (WA) has been designed to fill significant data gaps on temperature and fuel effects for biodiesel blend fuels in vehicles fitted with particulate traps:

- Test cycles will include a cold start Lower Speed Transient Mode (MHDTLO) from the

CARB MHDT three-mode test followed by a warm start MHDTLO and the Federal Urban Dynamometer Driving Schedule (UDDS).

- Testing will be conducted at a temperature between 68 °F (20°C) and 86 °F (30 °C)1 on one vehicles under both laden, 90% Gross Vehicle Weight Rating (GVWR) and unladen (50% GVWR) conditions.
- Core measurements will include Total hydrocarbon (THC), non-methane hydrocarbons (NMHC), non-methane organic gas (NMOG), oxides of nitrogen (NOx), nitrogen dioxide (NO2), carbon monoxide (CO), carbon dioxide (CO2) and particulate matter (PM)
- This program shall also generate speciated volatile organic compound (speciated VOC) data. VOC compounds of interest include C1 – C12 hydrocarbons as well as light alcohols and carbonyls.
- This program will also generate portable emissions measurement system (PEMS) data driving a specified route over local roads over a period of two weeks.

1 In accordance with 40 CFR 86.1330-90

The Contractor shall support vehicle preparation and operate the analytical bench to generate analytical data on exhaust gas emissions. The Contractor will provide a driver for two weeks of over-the-road PEMS testing.

Work Requirements

The Contractor will supply technical support including installing and maintaining all instrumentation and support equipment, as well as calibration, testing, and regulated emissions data processing activities. Two technicians will be required for the four weeks of chassis dynamometer testing and for two weeks of PEMS testing. These activities will be done in compliance with the EPA's Quality Assurance Project Plan (QAPP).

Task 1 Work Plan Development

The Contractor shall submit a detailed work plan to the EPA for approval. The work plan shall include a detailed description of how the tasks described below are to be performed, including details. The work plan shall include suggested alternatives for any of the required tests or procedures if such alternatives are thought to result in higher quality results.

The project work plan shall include descriptions of each task to be accomplished, along with detail on the level of effort, by professional grade, a cost breakdown for each task, and any information on the underlying assumptions used in arriving at these cost estimates. The Contractor shall conduct necessary activities to properly and efficiently manage the work assignment, including at least weekly communication with the EPA WAM.

Task 2 Conformance with Quality-Assurance Project Plan and Quality Management Plan (QAPP/QMP)

The Contractor shall perform project specific duties in accordance with the Quality Assurance Project Plan (QAPP) provided by the EPA. The plan shall detail sample data collection and analysis tasks and procedures for the proposed study. The QAPP shall describe measures designed to ensure data quality, including but not limited to:

- Standard operating procedures for equipment used to perform calibrations.
- Calibration frequency and schedule for all equipment used in testing (analyzers, dynamometer, chemical speciation equipment).
- Procedures for data transfer, entry and management.
- Procedures for regular transfer of all data generated in this project to the EPA Work Assignment Manager for review/audit, consistent with Task 6.4 of this Statement of Work.

The QAPP is attached but subject to modification prior to implementation. Any modifications to

the QAPP relating to Contractor activity will be provided to the WAL for review prior to implementation.

Task 3 Test Fuels and Lubricants

The Contractor will not be required to provide fuels. The Contractor will provide speciated analyses of the fuels sampled before and after project emissions testing and speciated analysis of the lubricant sampled after project emissions testing.

Task 4 Vehicle Procurement and Preparation

The Contractor shall not be required to provide a test vehicle.

The vehicle to be tested shall undergo a thorough inspection before beginning the test preparation sequence. This includes inspection and documentation of the engine, transmission, axles, exhaust system and tires, and documentation of the ECM status. Photographs of the vehicles' exhaust systems, engine plates, and emission plates shall be taken and included as part of the progress and final reports. The Contractor shall collect and record vehicle information as described in the Quality Assurance Project Plan (QAPP).

Each vehicle shall then undergo initial crankcase oil, oil filter and air filter replacement. Oil and air filters shall be procured by the Contractor according to manufacturer's recommendations. Engine oil recommended in the owner's manual of each vehicle shall be used. The recommended grade of lubricant shall be purchased.

After the last test of each vehicle in the program, the Contractor shall record the lubricant level indicated on the dipstick before collecting a 0.25-quart oil sample for analysis.

If any of the vehicles are equipped with traction control, the Contractor shall ensure that the traction control is disabled either through an interior disable button or other method (remove power fuse to anti-lock brake system (ABS), and place a placard in the vehicle indicating the method of disabling traction control if driver input is required.. The Contractor will be provided target road load coefficients and set road load coefficients for the test vehicles according to 40 CFR 1066.301 and 40 CFR 1066.310 (or the Contractor may propose and use an alternate method, subject to approval by EPA). For the purpose of this study, the agreed road load setting shall remain the same for all testing on a given vehicle.

The Contractor shall provide hardware and software for reading and archiving vehicle engine control module (ECM) data during emissions testing.

Task 5 Vehicle Testing

5.1 Basic Testing Protocol

The basic testing protocol begins with the a cold start Lower Speed Transient Mode (MHDTLO), followed by a warm start MHDTLO and the Federal Urban Dynamometer Driving

Schedule (UDDS). This protocol will be conducted in compliance with CFR Part 86 Subpart N, CFR Part 1065, and CFR part 1066. This test sequence will be repeated for each. This test sequence will be performed in both the laden and unladen conditions at both temperatures. Each test condition will be run on each vehicle at least three times. A fourth test may be run if necessary as described in 5.1.1. Tests will be performed on the 72-inch single roll electric heavy-duty chassis dynamometer. The EPA will provide the same driver to be used for all tests on a given vehicle.

The gaseous emissions to be measured and reported are THC, CH4, NO_x, NO_2, CO, and CO_2. The Contractor will use cleaned SUMMA cans to collect sample from which the US EPA will speciate the VOCs. The Contractor shall speciate the oxygenates. The Contractor will provide polyurethane foam (PUF) sorbent plugs and collect samples on which the US EPA will conduct PAH analyses. The Contractor will provide teflon filters for the EPA to perform metals analysis on the runs made on the light-duty dynamometer. The Contractor will provide DNPH cartridges and collect samples on which the US EPA will conduct carbonyl analyses. The Contractor will provide teflon filters on which the the US EPA will collect samples and perform gravimetric analyses.

During all emission tests, the Contractor shall record the following ECM parameters at the rate of 1 Hz using Contractor-supplied data acquisition equipment:

- RPM
- Vehicle speed
- Engine load
- Diesel Particulate Filter (DPF) loading
- Selective Catalytic Reactor (SCR) operation
- MIL status
- Absolute throttle position
- Engine coolant temperature
- Short term fuel trim-bank 2
- Long term fuel trim-bank 2
- Fuel/air commanded equivalence ratio
- Alcohol fuel percent
- Manifold absolute pressure
- Spark advance
- PID Control Module Voltage
- Air Flow Rate From Mass Air Flow Sensor

The facilities for testing shall be maintained in conformance with the requirements of 40 CFR Part 86 Subpart N or 40 CFR Part 1066 as they apply to vehicle emissions testing. THC, CH4, NO_x, NO_2, CO, and CO_2 emissions sampling and measurement shall be conducted as specified in 40 CFR 1065. The minimum detection limit for NO_2, measurements shall be 5 ppb. If some aspect of testing will need to be done in variance to the above specifications the Contractor shall describe why that is the case and how it may impact the test results. Variances must be approved

by the EPA WAM before testing may begin.

The Contractor shall verify that the tunnel flow remained constant during the test. The CVS blower shall be kept on for ½ hour before the first emission test on a given day and continuously between emission tests to ensure tunnel stability.

The Contractor shall provide defined and maintained cooling fan placement and flow for each test vehicle on all the tests. The flow of air sweeping the vehicle in the test cell shall be consistent between tests.

The Contractor shall perform "blank" UDDS tests at one month intervals during this program. These tests will involve running the full test sequence drawing only background air into the sampling system. All sampling systems will be operated and measurements will include:

- Phase level THC, CH_4, CO, NO_x, CO_2, PM, NO_2, VOCs (including alcohols and carbonyls)
- Continuous THC, CH_4, CO, CO2 and NO_x

5.1.1 Fuel Change and Test Execution Sequence

The Contractor shall follow the fuel change and test execution sequence described in Table 5.1-2, below making sure that during all refueling events the vehicle shall be parked in the same location, facing the same direction. A picture will be taken to document compliance. This picture will be submitted to the EPA with other QA documents.

The first three emission tests on a given vehicle and fuel combination shall be performed back-to-back. After three tests have been completed and the acquired data has passed all quality control verifications as described in the QAPP, the need for a fourth test shall be determined by following the variability criteria shown in Table 5.1-3. Specifically, if the standard estimate of error (SEE) of CO_2, NO_X or THC results from three tests on a given vehicle and fuel combination exceeds the levels shown in Table 5.1-3, the Contractor shall proceed with a fourth test and notify the EPA WAM within 24 hours, making available the electronic summary reports of the tests in question. The fourth replicate shall be run the same way as the third. The third and the fourth replicates shall also be done back-to-back.

Table 5.1-2. Fuel Change and Test Execution Sequence

Step	Description
1	Drain vehicle fuel completely via fuel rail whenever possible.
2	Turn vehicle ignition to RUN position for 30 seconds to allow controls to allow fuel level reading to stabilize. Confirm the return of fuel gauge reading to zero.
3	Turn ignition off. Fill fuel tank to 40% with next test fuel in sequence. Fill-up fuel temperature must be less than 50°F.
4	Start vehicle and execute catalyst sulfur removal procedure described in Appendix C of CRC E-60 Program report. Apply side fan cooling to the fuel tank to alleviate the heating effect of the exhaust system. Engine oil temperature in the sump will be measured and recorded during the sulfur removal cycle.
5	Perform four vehicle coastdowns from 70 to 30 mph, with the last two measured. If the difference between the last two coastdown times exceeds 0.5 sec. or their average differs by more than ±7% from the running average for that vehicle, then the vehicle will be checked for any obvious and gross source of change in its mechanical friction.
6	Drain fuel and refill to 40% with test fuel. Fill-up fuel must be less than 50°F.
7*	Drain fuel again and refill to 40% with test fuel. Fill-up fuel must be less than 50°F.
8	Soak vehicle for at least 12 hours to allow fuel temperature to stabilize to the test temperature.
9	Start vehicle and perform three Lower Speed Transient Mode (MHDTLO) , HD-UDDS, and MHDTLO cycle combinations. During these prep cycles, apply side fan cooling to the fuel tank to alleviate the heating effect of the exhaust system. Following the first two prep cycles, allow vehicle to idle in park for two minutes, then shut-down the engine for 2-5 minutes. Following the last prep cycle, allow the vehicle to idle for two minutes, then shut down the engine in preparation for the soak.
10	(Reserved)
11	Park vehicle in soak area at proper temperature (20°F (-6.7°C) or 75°F (23.9°C)) for 12-36 hours. During the soak period, maintain the nominal charge of the vehicle's battery using an appropriate charging device.
12	(Reserved)
13	Perform a Lower Speed Transient Mode (MHDTLO), soak 10 minutes, perform the three mode MHDT test, and perform the UDDS emissions test.
14	(Reserved)
15	Park vehicle in soak area of proper temperature for 12-36 hours. During the soak period, maintain the nominal charge of the vehicle's battery using an appropriate charging device.
16	(Reserved)
17	Perform a Lower Speed Transient Mode (MHDTLO), soak 10 minutes, perform the three mode MHDT test, and perform the UDDS emissions test.1.
18	Determine whether third replicate is necessary, based on data variability criteria (see Table 5.1-3).
19	If a third replicate is required, repeat steps 14, 15, 16 and 17. If the third replicate is not required, return to step 1 and proceed with next vehicle in test sequence.

* Step 7 shall be executed for vehicles selected by the EPA WAM following the refueling experiment described in Task 4 Vehicle Preparation.

Table 5.1-3. Variability Criteria for Triplicate Testing

Dilute Gaseous Emission	Criteria for requiring a third test (composite cycle emissions)
CO_2	SEE > 3%
NOx	SEE>10%
THC	SEE>10%

The criteria provided in Table 5.1-3 as well as cranking time criterion are expected to result in a 5% test replication rate.

5.2 Speciation of Volatile Organic Compounds (VOCs)

Sampling and analysis of alcohols shall be done using CARB method 1001, "Determination of Alcohols in Automotive Source Samples by Gas Chromatography" as modified by the MOP included in the QAPP. Sampling and analysis will be the responsibility of the Contractor.

Sampling and analysis of carbonyl compounds shall be done using TO-11a. Carbonyl sampling is to be performed by the Contractor. Carbonyl analysis will be performed by the EPA.

The Contractor shall seal and store alcohol samples at a temperature below 40°F immediately following collection. The Contractor shall make every effort to analyze these samples on the day they are collected, but no later than within six calendar days.

The Contractor shall provide segregated storage for alcohol and carbonyl samples to prevent their contamination.

No more than one vehicle shall be tested per test day, unless the Contractor can demonstrate that the total number of vehicles tested on that day and the timing of their tests will not compromise the time limit requirements imposed on sample analyses.

5.3 (Reserved)

5.4 PM measurement and Analysis

PM shall be collected on a Teflon filter and quartz filter for mass determination and subsequent chemical analysis. The sampling method shall allow for the collection of sufficient sample for chemical analyses. PM mass will be measured as specified in 40 CFR Part 1065. Two parallel filters will also be collect samples for each phase. Deviations from this method will require approval from EPA.

Task 6 Coordination and Support of Non-regulated Emissions Measurements

6.1 Laser Instrument

Support Edgar Thompson in the setup and operation for approximately two weeks of using the laser instrument

currently in the PT Cruiser. This will include the installation and initial operation of the additional laser calibrated to the measurement of formaldehyde as well as an additional channel to log the output data.

6.2 FTIR

Coordinate with Edgar Thompson as he conducts FTIR measurements from a probe into the dilution tunnel.

6.3 PAH

Coordinate with Michael Hays to provide sufficient media to sample PAH's for 3 of the five sample phases per test.

6.4 VOC

Coordinate with Tom Long or designee to use sufficient clean and prepared SUMMA cans for VOC analysis for all five sample phases per test.

6.5 Metals

Coordinate with Michael Hays to provide sufficient media for metals analysis on two of the five sample phases per test.

Task 7 Deliverables

7.1 Work Plan

The Contractor shall submit a work plan for this Work Assignment.

7.2 (Reserved)

7.3 (Reserved)

7.4 Monthly Reports

The Contractor shall provide monthly progress reports and invoices in accordance with contract. See the Reports of Work, EPAAR clause 1552.211-70, Submission of Invoices, EPAAR clause 1552.232-70.

Schedule of Deliverables

Steps	Completion Date
Project work plan submission	Within 20 calendar days of receipt of WA
Emissions Testing Start	July 8, 2013
Emissions Testing Complete	August 23, 2013

8 Mobile Source Dynamometer Research Laboratory Infrastructure Support (to be priced separately)

In fulfillment of the objective of this task, the following Subtasks shall be performed by the Contractor, and throughout the course of performing these Subtasks, the Contractor shall comply with the most recent MSDRL Quality Assurance Project Plan (QAPP) entitled 'Dynamometer Research' and the SOP for the dynamometer to be used that week. Total cost of LOE and ODC to complete Task 8 shall not exceed $107,000.

8.1.1 The Contractor shall prepare and operate the dynamometer, analytical bench and CVS sampling system in accordance with the CFR and laboratory protocols established by the EPA. Variances are permitted only by technical direction and/or approval of the WAM.

8.1.2 The Contractor will perform instrument/equipment evaluations and repairs as necessary to demonstrate and maintain proper operability and will assist in facility/equipment problem resolution

8.1.3 The Contractor shall acquire supplies, consumables, and calibration/reference materials needed to assess regulated emissions, PM2.5, carbonyls, VOCs, SVOCs, MSATs, and oxygenates. Gas standards will be procured from Scott Specialty Gases or a vendor whose compliance with EPA standards has been shown to be statistically equivalent.

8.1.4 The Contractor shall forward the raw data to the WAM on the day the samples are taken.

8.1.5 Quality assurance forms provided by the WAM to the Contractor will be completed in accordance with WAM technical direction. An electronic copy (PDF) will be provided to the WAM on the day of completion.

8.1.6 Protocols will be provided to the Contractor by the EPA Work Assignment Manager prior to initiation of the technical work.

8.1.7 The Contractor shall maintain a sample custody log of PM, DNPH, water impingers, passivated canisters, fuels, and bags submitted for sampling and/or received for analysis following sample collection. In the majority of cases, it may be necessary for a number of individual samples from a single source to be composited, thereby necessitating careful recording of the composited samples. The WAM will also notify the Contractor of the analytical method they plan to apply prior to analyzing any sample set.

8.1.8 The Contractor shall provide for appropriate handling and disposal of all laboratory waste materials, including expired test fuels.

8.1.9 The Contractor shall operate, maintain, modify, and calibrate analytical instrumentation and ancillary equipment in the EPA MSDRL. The Contractor shall maintain a file of operating manuals for all equipment and instruments. Equipment and instruments included in this Task are listed in Attachment 2.

8.1.10 The Contractor shall maintain a complete and up-to-date inventory for the MSDRL along with Material Safety Data Sheets for all chemicals and gases.

8.1.11 The Contractor shall supply to the WAM on a monthly basis a written progress report that includes: (1) a list by run number of the dynamometer tests completed; (2) a list by identification number of the samples provided for analysis; (3) description of experimental procedure used and any observed anomalous behavior; (4) list of calibrations completed with the date of each instruments calibration respectively, and (5) a general description of laboratory operations. The Contractor shall also provide to the WAM electronic copies of raw data sets.

8.1.12 Labor mix: To achieve the objectives of the WA the following labor mix is required:

a. A person with extensive (seven or more years) experience in operation of a dynamometer analysis bench. The bench technician requires the skills of the junior dynamometer technician (with the possible exception of driving the test vehicle), but much less theoretical knowledge than the senior dynamometer technician. The bench technician must have expertise in the area of wiring, plumbing, and trouble-shooting an analytical instrument bench. This requires a fundamental understanding of the principles of chemiluminescent detection, non-dispersive infrared detection, non-dispersive ultraviolet detection, and flame ionization detection. The bench technician must be able to perform instrument calibrations, understand the principles

behind these processes to properly assess corrective actions in the likely event of anomalous phenomena in the course of instrument calibrations. The bench technician is generally the first person to identify instrument malfunctions and bring this to the attention of the senior dynamometer technician. The bench technician must be familiar with the operational software for the dynamometer. The bench technician must understand and comply with the operational specifications for chassis dynamometers contained in the CFR. The bench technician must have experience in and knowledge of automotive systems, research fuels handling, and basic refrigeration;

b. The junior dynamometer technician must be strong enough to move heavy equipment (in accordance with OSHA regulations). The junior dynamometer technician assists the bench technician in all bench technician functions. The junior dynamometer technician will help prepare sample media and operate sampling equipment to collect mobile source samples. He will occasionally maintain the laboratory instrumentation, clean glassware and other laboratory consumables as required by quality assurance log samples as appropriate and other especially routine tasks. This individual shall pay special attention to detail as it relates to logging samples and recording substrate weights.

8.1.13 Provision of Spares, Parts, Equipment, and Instruments

Attachment 2 provides a list of required parts, components, equipment, and instruments. Additional parts, components, equipment, and instruments may also be required as directed by the WAM. These parts, components, equipment, and instruments must be directly applicable to the function of the light-duty, heavy-duty, small engine, or portable dynamometers and their sample systems.

a. The Contractor shall provide adequate spares, parts, equipment, and instruments to perform the weekly dynamometer emissions tests.

b. Spares, parts, equipment, and instruments will include but are not limited to those listed in Attachment 3.

Work Assignment Manager (WAM): Thomas Long
Alternate WAM: Richard Baldauf

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-64

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Village Green Air Sensor Proje

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period:	Cost/Fee:	LOE:
04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Gayle Hagler (Signature) (Date)	Branch/Mail Code:	
	Phone Number: 919-541-2827	
	FAX Number:	
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code:	
	Phone Number: 919-541-3670	
	FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code:	
	Phone Number:	
	FAX Number:	
Contracting Official Name: William Yates William Yates 4-18-13 (Signature) (Date)	Branch/Mail Code:	
	Phone Number: 513-487-2055	
	FAX Number:	

Statement of Work

Village Green Air Sensor Project

1.0 Background:

The Village Green Project (VGP) is a continuation from Option period III to build a novel air pollution measurement system that is solar powered, directly reading several air pollutants in real-time, wirelessly streaming weather and air pollution data to a website, and designed to be an attractive addition to a public outdoor space (e.g., community park or playground). During Option period III, the VGP prototype and accompanying website were developed. The challenging design requirements lead to the adoption of new technology (e.g., Arduino microprocessor) and modification of air monitoring instruments, such as engineering an automatic restart after power failure. At the conclusion of Option period III, it is expected that the prototype will be fully functional and assembled, including measurements for weather and three air pollutants (fine particles, black carbon, and ozone).

During Option period IV, the following two key activities will take place – (1) installation and ongoing maintenance of the VGP station at a community location nearby the EPA-RTP campus and (2) transfer of the VGP website hosted by the contractor to be an EPA-held website.

1.0 Task and Method Overview

These tasks shall provide the installation and maintenance of the VGP prototype, as well as technical support for transferring the contractor-held VGP website to be an EPA-hosted site. The WACOR will provide a QAPP supporting the system operation and outlining the cloud-processing data checks prior to posting data to a publically available website location.

3.0 Description of Tasks:

Task 1. Installation and maintenance of the VGP prototype

The VGP prototype shall be installed at a location within close proximity to the EPA-RTP campus in the April-May, 2013 timeframe. The location and installation date will be determined by the WACOR, which will be conducted in coordination with the site partner. The contractor shall ensure the installation is secure and positioned correctly. The contractor shall perform QA checks of the system prior to and at the point of installation, which will be outlined in the QAPP that will be authored by the WACOR. These QA checks are anticipated to be typical of air quality field studies, such as flow checks using a calibrated flow meter and multi-point calibration checks for gas-phase instruments. The contractor shall provide maintenance and repair of the VGP prototype during the option period year. Maintenance is anticipated to occur on a quarterly basis.

EPA staff will provide ongoing monitoring of the VGP prototype and will alert the contractor if repair is required. Cumulative maintenance and repair are not to exceed 40 hours, with no more than $5000 in consumables and repair expenses. At the end of the option period, the contractor shall remove the VGP prototype from the community site and move the prototype to the EPA-RTP campus.

1.1 The contractor shall document QA checks performed prior to system installation in a short report within 30 days of WA initiation.
1.2 The contractor shall document successful installation of the VGP prototype at the community location via a short report that includes photographs of the installation and documents on-site QA checks, within 30 days of system installation.

Task 2. Transfer VGP database and website

The contractor shall update the VGP database and website in advance of the website transfer. These updates shall include automatic QA checks and data processing steps that will be outlined in the QAPP, which will be authored by the WA COR. The contractor shall participate in planning meetings with EPA staff and other contracting firm staff who manage the EPA-hosted websites, in order to facilitate transfer of the VGP website to an EPA-hosted location. The contractor shall perform the necessary steps to transfer the VGP website to the EPA host and ensure it is correctly functioning after transfer.

Deliverable:
2.1 The contractor shall provide a completed VGP website hosted by the contractor, including automatic QA checks, within 30 days of WA initiation.
2.2 The contractor shall document successful transfer of the website to the EPA through short report and an archive of the website files (html code, figures, etc.), within 45 days of WA initiation. The report shall describe the back end database and website architecture in the original contractor-held and the final EPA-held site, and provide contact information for website troubleshooting.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-66

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	The Fate and Transport Mechani

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2):

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Xiaoyu Liu (Signature) (Date)	Branch/Mail Code:	
	Phone Number: 919-541-2459	
	FAX Number:	
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code:	
	Phone Number: 919-541-3670	
	FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code:	
	Phone Number:	
	FAX Number:	
Contracting Official Name: William Yates (Signature) 4-11-13 (Date)	Branch/Mail Code:	
	Phone Number: 513-487-2055	
	FAX Number:	

FY13 Statement of Work

WA Title: The Fate and Transport Mechanisms Study of Semi-Volatile Organic Compounds (SVOCs) in indoor Environment

1. Purpose

The overall objective of this project is to study the fate and transport mechanisms of Semi-Volatile Organic Compounds (SVOCs) in indoor environment to support the U.S. Environmental Protection Agency's (EPA's) sustainability activities on chemicals of concern. This project is to develop analytical methods and test protocols for studying the fate and transport mechanisms of SVOCs indoors and to collect data on parameters for quantifying the fate and transport of SVOCs indoors including partitioning between sources and air, source and interior surface materials and interaction between indoor sources and dust.

This WA is a continuation of WA 3-66.

2. Background

Improving air quality and assuring the safety of chemicals are two of the seven priorities for EPA's future addressed by the EPA Administrator. EPA has created the Chemical Safety for Sustainability (CSS) research program to enhance scientific approaches for understanding current and emerging chemicals, and how this is essential for effective environmental decision making in the 21st century.

It is well known that humans are exposed to multiple pollutants from multiple sources via different pathways and routes in the real environments. Many of the EPA's priority pollutants, including polychlorinated biphenyls (PCBs), brominated flame retardants, perfluorinated compounds (PFCs), bisphenol A (BPA), phthalates, and pesticides, are SVOCs and non- volatiles that are released from a vast number of building materials and consumer products. Understanding the transport mechanisms of these compounds between sources, air, house dust, and interior surfaces in residential environment will help to characterize human exposures, develop/refine

source-to-exposure-to-dose models, and develop strategies that enlighten risk assessments and policy decisions to minimize exposures and to protect human health.

Little is known about SVOCs source and exposure mechanisms. Because of the lack of standards or reliable methods for characterizing SVOC sources, fate and transport, it is often the case that the advance of data collection for SVOCs is far behind model development. The critical data gap for indoor SVOC research includes: (1) emission rates, (2) sorption rates, (3) critical parameters for exposure modeling: material/air partition coefficients and solid-phase diffusion coefficients, sorption rate constants, and (4) data to support the development of quantitative structure–activity relationship (QSAR) models and mass transfer models (including fugacity models) to predict the SVOC emissions and transport in indoor environments. Our research will directly support the Stochastic Human Exposure and Dose Simulation (SHEDS) and other exposure models by providing chemical concentrations and other parameters as part of the basic model input

In 2012, the ARCADIS Contractor under Contract EP-C-09-027 WA 3-66 had conducted 3 empty chamber and 1 sink material tests for 5 PCB congeners in the small chamber to evaluate sink effect of materials that potentially could be used for manufacturing the testing chamber and to develop method to measure SVOC's diffusion coefficients (D) and partition coefficients (K). Under this WA, the Contractor shall provide technical support to EPA by developing analytical methods and test protocols for studying the fate and transport mechanisms of SVOCs indoors. The potential SVOCs to be studied will be from different categories: flame retardants, phthalates, bisphenol A, and isocyanates, etc (Table 1). Selection of target SVOCs will be based on project needs, vapor pressure ranges, analytical methods, and availability of relative constant emission sources.

Table 1. List of Potential SVOCs for the Project

Category	SVOC	CAS#
flame retardants	PBDE (BDE-209)	1163-19-5
	TCPP	13674-84-5
	TDCPP	13674-87-8
	TCEP	115-96-8
	HBCD	3194-55-6
Phthalates	DnPP	131-18-0
	DBP	84-74-2
	DIBP	84-69-5
	BBP	85-68-7
	DnOP	117-84-0
	DEHP	117-81-7
	DINP	28553-12-0
	DIDP	26761-40-0
Bisphenol A	BPA	80-05-7
Isocyanates	4,4'-MDI (MDI)	101-68-8
	2,4-TDI	584-84-9
	pMDI	9016-87-9

3. Task Descriptions

The Contractor shall conduct the following tasks:

Task 1. Set up Analytical and Sampling Systems for SVOC Tests

The small chamber, micro chamber, and dual chamber systems will be used for the project. Test samples will be collected on sampling media, such as polyurethane foam (PUF) and Tenax. The contractor shall set up chamber testing system, sample collection and extraction systems. There are various existing analytical methods for SVOCs analysis, including gas chromatography / mass spectrometry (GC/MS), GC / nitrogen phosphorus detector (NPD), high-performance liquid chromatography (HPLC) and liquid chromatography / tandem mass spectrometry (LC/MS/MS). The Contractor shall review the literatures, set up analytical instruments and optimize analytical methods for the project.

Task 2. Develop SVOC Sources

Constant emission sources are important for SVOC sink effect and transport study. The Contractor was requested to develop constant emission sources of the flame retardants, TCPP, TDCPP, and TCEP, under WA3-66. Under this WA, the contractor shall develop constant emission sources for other SVOCs. The selection of target SVOCs will be based on project needs, vapor pressure ranges, analytical methods, and availability of the sources.

Task 3. Sink Effect Study

The contractor shall conducted small chamber tests to investigate the sink effect of flame retardants on stainless-steel chamber wall, materials that could be potentially used for manufacturing the interior surfaces of chambers, such as glass, polyethylene, polypropylene, and Teflon, and building materials, such as carpet, gypsum board, concrete, vinyl flooring, and ceiling tiles. The contract shall develop and improve sampling methods for chamber testing.

Task 4. Indoor Sources and Dust Study

Besides the sink effect study, the contractor shall conduct chamber tests to study the transport mechanisms between indoor SVOC sources and settled and/or suspended dust. The work plan will be developed with consultation of the WAM. The Contractor shall write a QAPP amendment as needed with the progress of the project and the change of the scope of work.

4. Schedule of Tasks, Reports, and Deliverables

The Contractor shall submit the updated QAPP within 30 days of receiving the directions from the work assignment manager (WAM) for the new tasks. The Contractor shall finish the sink effect study of the three flame retardants (TCPP, TDCPP, and TCEP) by July 31, 2013. The Contractor shall also provide (1) test material information; (2) environmental data for each test; (3) sampling information; (4) analytical data in excel files. These shall be submitted to the WAM within 10 business days after each test.

The Contractor shall provide the EPA WAM monthly progress reports as specified in the contract. The Contractor shall alert the WAM in advance if they expect a substantial delay in completing the task or submitting the deliverable.

5. Suggested Skills

This project will require Contractor staff with the skill of modification and adaptation of scientific apparatus to meet project objectives. It is recommended that this Work Assignment be led by a scientist or engineer with experiences in testing product emissions and operating small environmental chambers. A skilled analytical chemist with experiences of SVOC analysis is also needed.

6. Special Requirements

The Contractor shall provide necessary health and safety procedures, documentation, and training to Contractor staff to ensure safe conduct of the experiments at Contractor controlled facilities.

The contractor shall adhere to the QA requirements as delineated in Attachment #1 to the Statement of Work. Work shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

7. Work Assignment Manager Designation

The Work Assignment Manager (WAM) is:

Dr. Xiaoyu Liu
U.S. Environmental Protection Agency
National Risk Management Research Laboratory
Air Pollution Prevention and Control Division
Indoor Environment Management Branch
Mail Code E305-03
Research Triangle Park, NC 27711
Telephone:. 919-541-2459
Fax: 919-541-2157
E-mail: liu.xiaoyu@epa.gov

8. Work Assignment Duration and Level of Effort

The period of performance for this work assignment is from the date this work assignment is issued through March 31, 2014.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-67

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014	
	Base X Option Period Number	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Lukas Oudejans (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-2973 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 3/21/13 (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK
Contract EP-C-09-027

PROJECT NUMBER C.2.2.4.01

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. TITLE

Decontamination Solution Methods for Toxic Industrial Chemicals

II. PERIOD OF PERFORMANCE

The period of performance for the tasks detailed in this Statement of Work (SOW) shall be from time of award until March 31, 2014.

III. SUMMARY OF OBJECTIVES

This work will continue to develop standard test methods for the evaluation of currently used decontamination solutions against toxic industrial chemicals and chemical warfare agent (CWAs) simulants as applied to materials that are representative of non-disposable personal protective equipment (PPE) or storage container materials containing potential forensic evidence.

IV. BACKGROUND

In the event of a chemical/biological incident, materials must be collected, preserved, and analyzed to conduct a successful investigation whether a crime has been committed. Such forensic analysis of evidence is often crucial to identification of perpetrators and determinations of guilt or innocence. Collection of such evidence most likely will result in contamination of non-disposable PPE and equipment. Following the proper packaging of the evidence, the outside of (secondary) containers as well as non-disposable PPE must be decontaminated. Efficacies of currently used decontamination solutions against toxic industrial chemicals (TICs) and pathogens bound on or in PPE materials are not always known. In addition, compatibility of the contaminant and decontaminant with the PPE materials must be determined.

Currently NHSRC is evaluating decontamination technologies against CWAs or their simulants as part of response/recovery operations. NHSRC has gained significant experience in decontamination technology testing and has the facilities and expertise to conduct such testing against most toxic industrial chemicals and CWA surrogates. In this work, the efficacy of currently used decontamination solutions against TICs and CWA surrogates on various PPE related materials will be systematically evaluated. The effect of the decontaminant solution on the PPE materials will also be assessed qualitatively. This WA is a continuation and completion of efforts started under previous WA 3-67.

V. SCOPE

The goals of this project are to provide responding agencies with information on material compatibility and efficacies of currently used decontamination solutions against TICs and pathogens on materials/surfaces of interest. During Phase I (this WA and previous WA 3-67), the emphasis will be on selected non-reusable PPE and evidence container materials while potential future Phase II materials may be considered that make up the outer package of reusable equipment such as detectors. This second phase will also evaluate other parameters such as decontamination exposure time, amount applied, and application method on their influence of the efficacies. Some materials studied under this effort (specifically wood and stainless steel) are also pertinent to decontamination of civilian facilities.

VI. TECHNICAL APPROACH

Details for the general technical approach can be found in Section X but the overall technical direction follows the approach established under previous WA 3-67. Under this WA, methods were developed to test decontamination solutions similar to how they would be used in the field during decontamination procedures of PPE and PPE-related materials. The contractor shall use the extraction methods demonstrated for the targeted chemicals from all (7) materials described under WA 3-67 and shall use the neutralization/quenching methods to halt the decontamination reactions by the specific decontamination solutions. During decontamination testing, the decontamination efficacy shall be determined for destruction of specific combinations of chemical/decontamination solutions from all materials. Material effects shall also be visually assessed. A draft test/QA plan for these experiments was approved on 10/17/2013. The contractor shall work with the EPA WAM to update this QAPP through amendments, if required.

VII. AFFORDABILITY

Method development, decontamination testing and preparation of extracts are expected to be somewhat labor intensive. Analysis is expected to be performed by an accredited chemical analysis laboratory. In comparison to the labor costs, only a minimal amount of expendable materials are required to be purchased by the contractor.

VIII. TECHNICAL RISK

The technical risk involved in this project is considered to be minimal. The goal is to provide information related to the efficacy of currently used decontamination methods against various chemicals as present on PPE related materials. All information obtained is expected to be relevant.

IX. FACILITIES AND MATERIALS

All work on this project described in this statement of work shall be performed at the U.S. EPA's facilities located at 109 TW Alexander Dr, Research Triangle Park, NC. Decontamination testing is anticipated to be performed in a chemical hood in H-210 while chemical analyses of the samples are expected to be mostly subcontracted to an outside chemical analysis laboratory.

X. TASKS

The contractor shall perform the following tasks as part of this work assignment. All method development related to verification of the extraction procedure and methods to quench/neutralize the decontaminant were completed under WA 3-67.

TASK 1. DEVELOPMENT OF QAPP AMENDMENTS

The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2.

A QAPP, entitled "Decontamination Solution Studies against Chemical Agents on Personal Protective Equipment and Related Materials" was approved on October 17, 2012. Amendment 1 to this QAPP was approved on December 21, 2012.

The EPA WAM will prepare amendments to this QAPP, if required, in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf and the NHSRC Quality Assurance (QA) requirement as defined in Attachment #2 to the SOW. Draft QAPP amendments will be provided for comments to the contractor before review by the EPA Quality Assurance Manager. The contractor and EPA WAM shall respond to comments and submit the QAPP amendments for approval to the EPA Quality Assurance Manager. The QAPP amendments, shall be approved by the U.S. EPA in writing (e.g., signature on the approval page) prior to the start of work affected by the amendment. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

TASK 2. CHEMICAL ANALYSIS

The contractor shall maintain contact with selected accredited chemical analysis laboratory for chemical analysis of the extraction samples except for analysis of malathion-related samples which will be performed in-house in the EPA/NRMRL Organics Support Laboratory. The contractor shall be responsible for all communications with the subcontractor, including Quality Assurance and Quality Control of analysis and results. The contractor shall receive QC data reports from the subcontractor. The contractor shall ship extraction samples as created under Task 3 to the subcontracted chemical analysis laboratory. The contractor shall coordinate analysis of malathion samples with EPA/NRMRL personnel.

TASK 3. SYSTEMATIC EVALUATION OF DECONTAMINATION SOLUTIONS

Coupons shall be contaminated with the target chemical by applying nominal 20 μL of the neat chemical. Application of the decontamination solution in the field would occur as a spray, wipe or foam. However, to reduce variability in the applied decontamination solution amount per surface area, the contractor shall either apply a

fixed volume (nominal 100 μL) of decontamination solution or the foam generated from such volume per surface area as per direction of the decontamination product's vendor. Note that in the case of one decontamination product (RSDL), the liquid from a soaked wipe pad will be applied to the surface without use of the pad.

A test matrix shall be constructed using the chemicals, materials, and decontamination solutions tabulated. The decontamination efficiency for a specific chemical / decontamination solution pair as shown in Table 1 shall be obtained.

Table 1: Test Matrix. Only combinations marked "X" will be tested

Agent	Decontaminant								
	Soap and Water	Bleach	Diluted Bleach	pH-Amended Diluted Bleach	EasyDecon DF-200 Solution	EasyDecon DF-200 Foam	RSDL	SteriPlex Ultra	3-point persistence
Acrylonitrile (99%)	X				X	X	X		X
Chlordane(99%)	X				X	X	X		X
Malathion (99%)	X	X	X	X	X	X	X	X	X

For each test point, extracts from test coupons (contaminated and decontaminated), positive control (contaminated and not decontaminated), procedural blank (not initially contaminated but decontaminated), and spike controls (see Table 2) shall be analyzed for the targeted chemical. Two laboratory blanks (not contaminated and not decontaminated) shall be included per test point (see Table 1) assuming that each test point is completed on a single day of testing. If a test point cannot be completed on a single day, additional sets of laboratory blanks shall be generated. These are not included in the calculation of number of samples to be analyzed. Spike controls are defined as samples in which the target chemical is directly spiked into the extraction solvent. These controls function as independent verifications of the subcontractor laboratory analysis results (at a high and low concentration level). One additional positive control coupon and one additional procedural blank coupon shall be evaluated qualitatively on the impact of the chemical and decontamination solution on the material, respectively.

Table 2: Sample types per test chemical/decontamination pair for all materials. See text for laboratory blank numbers

	Test Coupons	Positive Controls	Procedural Blank	Spike Control High	Spike Control Low
Extract Analysis	3	1	1	2	2
Coupon evaluation	0	1	1	0	0
Total	3	2	2	2	2

In addition to the decontamination testing, a separate three (time-) point persistence test at t = 5, 15, and 45 min from the moment of contamination will be included for every chemical on every material. Each of these persistence tests shall consist of three persistence coupons per time point accompanied with a single laboratory blank taken after 45 minutes.

The test matrix in Table 1 with associated coupon description in Table 2 shall be repeated for seven materials (stainless steel, nitrile, butyl, viton, polyvinyl chloride, neoprene, polyethylene) as prepared under WA 3-67. For each test, there will be a 30 minute delay (dwell) time between the moment of application of the chemical to the surface and the actual start of the decontamination procedure. Absolute exposure time of the decontamination solution with the chemical will be 2.0 minutes.

The contractor shall expect to prepare 7 [materials]×7 [coupons per test] = 49 coupons per decontamination solution/ chemical pair (excluding laboratory blanks) of which 35 shall be analyzed for chemical amount and 14 for qualitative evaluation of the material (no chemical analysis). Since there are a total of 16 decontamination solution/ chemical pairs (see Table 1), each with one associated with 4 spike controls, 2 laboratory blanks per material per chemical, and 21 persistence test points, the total test matrix requires chemical analysis of (35×16)+(4×16)+(2×3×7)+(21×10)= 876 samples.

Since analysis of malathion-containing samples (396 samples) will be conducted in-house by EPA personnel, the actual number of samples from this test matrix requiring chemical analysis by the external chemical analysis laboratory is 480.

In the case of decontamination testing of surfaces contaminated with malathion, the contractor shall generate GC-ready extracts to EPA/NRMRL personnel, which shall include an internal standard.

Extraction samples shall be analyzed according to the analytical techniques described in the following (EPA) methods (Table 3). Alternative methods as proposed by the external chemical analysis laboratory or contractor shall be provided for discussion and approval by the EPA WAM.

Table 3: Chemical Analysis Methods

Chemical	EPA Method	Matrix	Analysis by	Target Analyte(s)
Acrylonitrile	8031	Water	GC/NPD[a]	Acrylonitrile
Chlordane	8081B	Organic Solvent	GC/ECD[b]	Chlordane
Malathion	8270D	Organic Solvent	GC/MS[c]	Malathion and Malaoxon[d]

[a]: GC/NPD: Gas Chromatography / Nitrogen-Phosphorous Detection
[b]: GC/ECD: Gas Chromatography / Electron Capture Detector
[c]: GC/MS: Gas Chromatography / Mass Spectrometry
[d]: Malaoxon is a metabolite of malathion with a higher toxicity

Prior to the application of the bleach-based decontamination solutions, the contractor shall measure the pH and free available chlorine. Prior to the application of the EasyDecon® DF200 product, the contractor shall use the provided test kit to test the stability of this product.

The effect of the decontamination method and of the chemical itself on the material shall also be determined. The integrity of the material shall be tested using visual inspection and documented with (digital) photographs taken of the additional procedural blank and positive control before the decontamination solution (or chemical) is applied and at the end of the decontamination interaction time of the solution.

XI. DELIVERABLE SCHEDULE

On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, cumulative financial expenditures and cost and schedule variance.

The deliverables in the form of completed data sheets are shown in Table 4.

Table 4: Deliverable Schedule.

Task Number	Deliverable	Due Date
	Biweekly research meetings	N/A
1	Review of QAPP amendments	1 week from receipt of draft amendment by EPA WAM
3	Efficacy, and persistence data for all three chemicals	2 months from award of this WA

XII. REPORTING REQUIREMENTS

- Data related to this project shall be stored on the US EPA server's DTRL shared drive;
- Transfer of project data shall occur at the conclusion of each experiment within each task. Detailed written summaries of experimental procedures and results shall be provided to the WAM within one week from receipt of the data analysis. These reports shall indicate the operational conditions (e.g. decontamination solution preparation procedure and exposure time);
- QC reports from the subcontractor shall include raw peak areas from the mass spectra or chromatograms (where applicable), the calibration data sets for the analysis method of the coupon extracts, the measured agent concentrations on all of the

coupons (test coupons, procedural blanks, positive controls, laboratory blanks, and spike controls);

- Reporting sheets using MS Excel 2007 for Task 3 shall be developed by the contractor, reviewed by the EPA WAM and used for data reporting;
- All photographs and videos shall be properly documented by providing information on the test conditions under which they were taken.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-68

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Investigation of Black Carbon

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Tiffany Yelverton (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-9456 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates (Signature) (Date)	William Yates 3/21/13	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK

Investigation of Black Carbon Emissions from Stationary Diesel Engines

I. Background

A recent National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Reciprocating Internal Combustion Engines (RICE), written by EPA's Office of Air Quality Planning and Standards (OAQPS), was finalized in March 2011. This NESHAP will help control the emissions from internal combustion engines, both diesel and spark-ignited IC engines. Even as specific as the verbiage for each engine was in the ruling, portions of the ruling were left open for further investigation as needed in the future. One such instance of this pertains to off-road stationary diesel generators. At the time the ruling was proposed and finalized, it was unclear as to whether or not these diesel generators were of concern for particulate emissions, particularly black carbon (BC). While the investigation described within is a set of tests designed to determine whether or not BC is of interest for further testing by providing emission factors, it is NOT to inform OAR/OAQPS of needed emissions standards or regulations.

Specifically, this work will continue to investigate PM, BC, and gaseous emissions (CO, CO_2, O_2, etc.) from three different diesel generators with varying loads with and without after-market emission controls in use. Three engines have been selected for the purposes of this testing and three categories of after-market emission control devices have been selected for use on each engine independently: active diesel particulate filter (DPF), passive diesel particulate DPF, and diesel oxidative catalyst (DOC). The three engines that will be used for testing are Caterpillar engines with approximately 300hp (model XQ230 LEHE5329), 500hp (model XQ400 LEHX0758), and 700hp (model XQ600 LEHX0530). Each engine will be run at two conditions: approximately 50% and 75% load. Each of the three emissions control devices will be tested individually per engine at the above mentioned engine loadings. The exhaust from these engines will be ducted into the Highbay building (at EPA's RTP location) and into the flue gas cleaning system (FGCS or APCS). From these exhausted emissions, a slip stream will be pulled for sampling purposes. Under certain testing conditions, dilution will be necessary in order to avoid overwhelming the measurement instrumentation.

II. Purpose

These tests will be used to further understand emissions from stationary diesel generators. These tests are specifically designed to investigate particulate emissions, but will require gaseous emissions investigation as well. The ultimate goal of the investigation will be to provide emission factors for both uncontrolled and controlled emissions under varying engines loads. All tests must be run with ultra-low sulfur diesel (ULSD) fuel. The resulting data will be used by ORD and by OAQPS/OAR. The results of these tests will NOT be used to set emission limits or to determine NESHAP rules.

Background Information and Special Instruction

- It is expected that much of the data obtained via this work assignment may be dispensed to the general public via open presentation at technical conferences and through publication in peer-reviewed scientific journals.
- The Contractor is expected to use government furnished equipment (GFE) for this work and shall work with the WAM to accomplish these tasks.
- Facility operating manuals and standard operating procedures shall be followed when applicable and available.
- The Contractor shall participate in safety training as per EPA guidelines.
- The Contractor shall adhere to the QA requirements as delineated in Attachment #1 to the Statement of Work. Any work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Stuff.

III. Statement of Work

Task 1. Review/Revise QAPP (as needed)

Prior to the start of the testing period, the contractor shall work with the WAM to review the existing QAPP, "Investigation of Black Carbon Emissions from Stationary Diesel Generators," in order to ensure that the description of all sampling practices/methods and the test plan are current and accurate.

Deliverables – The contractor shall work with the WAM to review, and revise as needed, the quality assurance project plan (QAPP) to ensure its accuracy and that it is in accordance with Appendix #1 (attached) to the Performance Work Statement for each work assignment task involving collection or generation of environmental data. The QAPP must be approved by the QAM prior to any data being acquired or used (by 05/31/2013).

Task 2: Rent Test Engines

The contractor shall rent the needed engines for the testing sequentially rather than simultaneously. Each engine rental will be needed for nominally six to eight weeks. Thus the contractor shall supply the following three specific Caterpillar diesel generator models (horsepower): XQ230 LEHE5329 (~300hp or 230kW), XQ400 LEHX0758 (~500hp or 400kW), and XQ600 LEHX0530 (~700hp or 600kW).

Deliverables – The contractor shall provide the three rental engines for testing in series. The contractor shall provide these engines within three weeks of request from the WAM (for each engine), and should arrange return of the engines within two days of completion of testing to avoid extra leasing costs.

Task 3: Conduct Runs According to the QAPP/Test Plan

Each test "run" shall be one 4- to 7-hour day of operation, where sampling period will depend upon control devices being tested. It is likely that two to three test runs per week shall occur. The contractor shall be responsible for engine operation and preparation of the sampling equipment and glassware for all of the runs; however, the contractor shall not be responsible for day-to-day operation of the online black carbon (PASS3, SP2, AE22), mass spectrometry, or reactive oxidative species instrumentations. The contractor shall, in coordination with the WAM, conduct experimental runs according to the schedule and conditions described in the existing/revised QAPP which includes testing up to three different generators with multiple configurations of the available emissions control technologies (as described in the below table).

Projected Conditions for Each Test

Engine (operating on ULSD)	**Emissions Control**	**Engine Load**	**Number of Test Days**
~300hp (230kW)	none	~50% and ~90%	1-2
	Active DPF	~50% and ~90%	1-2
	Passive DPF	~50% and ~90%	1-2
	Oxidative catalyst	~50% and ~90%	1-2
~500hp (400kW)	none	~50% and ~90%	1-2
	Active DPF	~50% and ~90%	1-2
	Passive DPF	~50% and ~90%	1-2

	Oxidative catalyst	~50% and ~90%	1-2
~700hp (600KW)	none	~50% and ~90%	1-2
	Active DPF	~50% and ~90%	1-2
	Passive DPF	~50% and ~90%	1-2
	Oxidative catalyst	~50% and ~90%	1-2
	Total Test Days		**12-24**

Deliverables – The contractor shall provide the WAM with three rental engines (sequentially, not simultaneously), an engine operator, needed test equipment, and support for sample collection for all scheduled test days.

Task 4: Coordinate Analysis of Experimental Samples

The contractor shall, when needed, coordinate the transport and analysis of experimental samples using appropriate off-site analytical laboratories. The specific analytical requirements will be described in the QAPP. While the exact number of samples to be analyzed off-site is unknown at this time, filters for organic and elemental carbon concentrations (NIOSH5040) will need to be analyzed off-site.

Deliverables – The contractor shall provide chain of custody reports for all samples sent off-site for analysis as well as the results reported from these analyses. For on-site sample analysis, the contractor shall provide results from these analyses. For off-site analyses, the contractor shall initiate transport and analysis of samples within two weeks of collection.

Task 5: Assemble Run Data and Analytical Results into a Usable Data Package and Provide a Written Summary

The contractor shall assemble the run data (i.e. experimental conditions) and analytical results into formats that can be used or reported. The contractor shall work with the WAM to ensure that the appropriate data formats are used. The contractor shall write up a short summary report following each run and should further assemble analytical data into table and plot formats if needed.

Deliverables – The contractor shall provide analytical results and the data package within two weeks of receiving analytical reports from the off-site laboratory.

Task 6. Procurement of Fuel for Operation of the Stationary Diesel Generators

The Contractor shall procure any needed ultra-low sulphur, non-highway diesel fuel. The Contractor shall work with a local company to purchase needed fuel and have it delivered to EPA's RTP campus for the purposes of this investigation. The diesel fuel shall be delivered and stored on-site in an approved storage facility. The Contractor shall be responsible for ensuring that the fuel storage facility is prepared properly, with assistance from the WAM, for the delivery of the fuel.

Deliverables – The Contractor shall provide the needed diesel fuel for testing. The fuel shall be procured and delivered no later than two weeks after the WAM makes a request.

IV. Other Deliverables

The Contractor shall provide the WAM with a records Package at the completion of the tasks of this work assignment (03/31/2013). This records package shall contain copies of laboratory data sheets, experimental observations (in a lab notebook), minutes of meetings, etc. The records package shall contain enough information such that the work could be independently repeated if desired.

The Contractor's monthly report to EPA shall summarize work activities (accomplished and planned) for each task in this work assignment, including (but not limited to) the status of applicable tests, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges.

All safety and quality assurance requirements for APPCD projects are documented in protocols prepared prior to initiating a project, as required in the Contractor's contract. As part of the EPA-RTP's normal operational requirements, a detailed facility health and safety plan shall be prepared by the Contractor for each of the experimental systems that will be used for this proposed research. Health and safety protocols for each task shall be updated or prepared as required by the EPA-RTP Campus Safety personnel. These protocols shall be approved by the WAM and safety personnel prior to conducting any tests.

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW) FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function; 07/14/08 A-2
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

□ **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

□ **QAPP Requirements for Software Development Projects**

□ **QAPP Requirements for Method Development Projects**

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

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NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-70

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Region 3 Energy RARE Projects

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW: Section 7

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments: WA 4-70

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
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4										
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Eben Thoma (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7969 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates 3-27-13 (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

SOW: EPA Region 3 Energy Rare Projects
EP-C-09-027, WA 4-70 base

Background:

In 2012, EPA Region 3 and EPA ORD began a collaborative project under the ORD RARE program to improve understanding of potential air pollution impacts of energy production activities in the region including oil and gas production and petrochemical refining. The first phase of the project is designed to conduct measurement method research to inform baseline levels of select volatile organic compound (VOC) and hazardous air pollutant (HAP) concentrations in areas around a refinery complex in South Philadelphia. The second phase of the project plans to use similar methods to investigate select air pollutant concentrations and source assessment approaches in areas around oil and gas production operations in Region 3. Background information on these efforts can be found in EP-C-09-027 WA 3-17 and WA 3-70.

This collaborative project has multiple objectives that include both improved information on air pollutant concentrations in areas around sources and advancement of low-cost measurement technologies, specifically two-week diffusive tube passive sampler (PS) systems deployed in novel configurations. These projects are designed in part to further inform draft PS methods 325 A and B and to advance information on the average air pollutant concentrations in areas around the target source. Projects under WA 4-70 will contribute to a larger set of PS efforts pursued under other work assignments. A component of WA 4-70 will help assess the ability of commercial laboratories to analyze for a primary risk driver compound, benzene, while EPA core labs will investigate robust extension of the PS approach to other compounds sets. A component of WA 4-70 will help investigate the viability of two-week PS deployments in complex source environments and the ability of PS deployments to assess isolated source emissions though novel inverse estimation approaches using time-integrated samplers. Components of this effort link to ongoing work under WA 4-17 that develops and tests other forms of next generation measurement methods. Related to this, the ORD and R3 team is collaborating with the City of Philadelphia's Air Measurement Services (AMS) on their new EPA Communities-scale Grant project that use optical remote sensing for measurement of benzene and other compounds in the Phase 1 study area.

Phase 1: Philadelphia Passive Sampler Method Study

Reducing fugitive emissions of HAPs, VOCs, and certain inorganic gases from industrial facilities is an ongoing priority for EPA and state and local regulators and our industries. Development of cost effective methods for detecting fugitive emissions and monitoring air pollution concentration levels at industrial facility fencelines can yield many benefits including protection of public health and worker safety, improved emission inventory knowledge and even cost savings by helping to reduce product loss. Fugitive emissions are however difficult to characterize due to the spatial extent of the potential sources at each site, and the temporal variability of the emissions.

Time-integrated passive sampling (PS) techniques are an important emerging technology for fenceline monitoring at industrial facilities. Data collected with PS, when coupled with data from time-resolved monitors and meteorological sensors, could be used by facilities to pinpoint and repair fugitive leaks more quickly and efficiently, greatly reducing the potential for emissions. As a lower-cost sampling method, PS technologies also have utility for stake holders to acquire time-averaged concentration measurements of select compounds in a variety of use scenarios. A common time period for PS screening deployments is a two-week integration time. Although two-week PS deployments are believed to provide a robust measure of time-averaged concentrations for select pollutants (such as benzene), the degree to which source apportionment information can be acquired is uncertain. The reason for this is that the longer the sampling time, the more upwind foot print contributes to the acquired signal. In mixed source environments with varying wind directions, the acquired signal on a two-week passive sample is a complex function of source strength, proximity and metrological variables. Amongst other objectives, this project helps inform the degree to which spatial gradient deployments from two-week PS deployments can be useful in decoding source contributions in complex environments. Phase 1 of the project has the following objectives:

- Work with other efforts to provide information on two-week PS in support of draft methods 325A and B, including evaluation of commercial laboratory analyses for benzene if funding allows.
- Investigate the utility of spatial gradient deployments in complex source environments to ascertain probable source contributions to signal.
- Provide baseline information on two week time-averaged benzene concentrations in the deployment area.
- Investigate the viability of novel deployment scenarios of PS in public spaces.
- Expand information the PS compound set for Carbopack X.
- Collaborate with the City of Philadelphia Air Measurement Services (AMS). EPA Communities-scale Grant project using optical remote sensing for measurement of benzene and other compounds in the study area.
- As possible, link to WA 4-17 for testing of low cost time-resolved sensor technologies.

Phase 2: Region 3 Oil and Gas Passive Sampler Method Study

(Excerpts modified from EPA R3/ EPA ORD and 2012 RM passive sampler proposals)

As oil and gas production increases in many areas of the United States, there is a growing need to improve understanding of emitted VOCs, HAPs, greenhouse gasses (GHGs), and criteria pollutants, from this sector. The source characteristics and information needs differ from region to region but share several common characteristics. As the number of sources increase, the potential impact of the emitted VOCs on regional ozone must be assessed. Since oil and gas production operations can exist in close proximity to

populations, the potential for hazardous multipollutant emissions and local air quality impacts must be better understood.

To help achieve the goal of sustainable, environmentally responsible development of oil and gas resources, it is necessary to understand the potential for air pollutant emissions from various production processes. To compliment on-site measurement approaches, development of lower-cost, longer duration observation techniques for studying emissions and near-source concentrations around oil and gas operations is an important emerging area.

Oil and gas production operations can include waste water holding and evaporation ponds as part of the upstream process. Knowledge of air pollutant emissions from these ponds is somewhat limited and levels of emissions and their variability in time and by process condition are difficult to measure and model. This project, conducted by EPA's Office of Research and Development and EPA Region 3 in collaboration with the oil and gas industry, aims to develop and test new low cost measurement methods to help improve understanding of air pollutant emissions from oil and gas ponds.

Specifically, this project phase explores use of lower-cost passive samplers (PS) to produce multipoint air pollutant concentration measurements around oil and gas ponds. The project also explores ways that these measurements could be used to estimate emission levels from the ponds and how the engineering and work practices of the producers may affect emissions and near source concentrations. Since PS are low cost, data can be collected over an extended period of time, allowing the variability of emissions and the effects of technology and work practice changes to be potentially assessed.

This project phase will be conducted in collaboration with industry partners that are currently being identified by EPA. The field deployment portion cannot proceed until the collaborative arrangements are made. A QAPP outlining the research, use of data, and roles and responsibilities of the parties shall be written by the contractor with technical input from the project team. In the most likely scenario, a number PS will be deployed in areas around a pond. In addition, a canister or other comparison metric, and a field meteorological station will also be set up at one or more facilities. Every two weeks the tubes will be changed by EPA representatives or the collaborators. The passive samplers will be analyzed by one or more quality assured laboratories and the data shared. To support the measurements, data on process operation changes and periodic water samples will be gathered by the group to provide maximum utility for the project. Quality assurance sampling and comparative analysis will be designed in conjunction with the collaborator to ensure that acquired data is of known uncertainty. All sampling methods, modeling, and data acquired or developed as part of this research effort will be shared with the industry collaborators.

Phase 2 of the project will:

- Work with other efforts to further information on two-week PS in support of draft methods 325A and B, including evaluation of commercial lab analyses for benzene as funding allows.
- Investigate the utility of PS for oil and gas source assessment.

- Provide information on two week time-averaged benzene and other select compound concentrations in the deployment area.
- Investigate novel deployment scenarios of PS around oil and gas sources.
- Expand information the PS compound set for Carbopack X.
- As possible, link to WA 4-17 for testing of low cost time-resolved sensor technologies.

Quality Assurance Notes for Phase 1 and Phase 2 Projects

These research projects (Phase 1 and Phase 2) are not related to nor do they attempt to inform any enforcement or compliance activities in these areas. The intended use of the generated data from these projects is primarily for near-source research and method assessment purposes.

Phase 1 project: Based on the intended use of the data and elements of project design (including state of draft PS method and planned PS public deployment scenarios), this project phase will operate formerly under an EPA ORD Category 3 QAPP (applied research and development projects). To ensure the highest known data quality, applicable elements of EPA Category 2 Field QA (duplicate and field blank levels), sample handling, chain of custody, and laboratory analysis QA and documentation will be incorporated.

Phase 2 project: Since viable site security for the PSs is envisioned and significant comparison measures are anticipated, the field measurement portion of this project will be executed as an EPA Category 1 QAPP. Investigations on the use of time-integrated sampling for potential source assessment will operate as QA Category 3 QAPP appendix (applied research and development project) due to the state of development of the approach.

Work involving collection of environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff. The Quality Assurance Project Plans (QAPPs) associated with these tasks must include all necessary elements as described in the referenced documentation (See Attachment 1). Tasks added under future WA Amendments and may require development of additional QAPPs. All QAPPs shall be reviewed and approved by the ARCADIS work assignment leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the ARCADIS work assignment leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the ARCADIS work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page.

For work involving analysis by outside laboratories, the contractor shall review and document all subcontractor quality management plan information as per current contract and EPA QA policy requirements.

Task and Deliverable Schedule Breakdown:

Project Phase 1 pertains to Tasks 1-2 whereas Project Phase 2 to Pertains to Tasks 3and 4. The contractor shall provide an itemized cost and hours estimate for each of the tasks.

Task 1: Completion of Phase 1 QAPP and project arrangements (if necessary)

At time of SOW writing (Jan 2012), the QAPP and project planning deliverables for phase 1 (including arrangements for potential subcontractors, PS site access agreements, safety plans, QAPP approval, etc.) were scheduled for completion prior to the end of option period 3 (executed under WA 3-17, Task 10). In the event that delays were encountered in completion of any necessary project planning or QAPP deliverables required to start the field sampling for project, the contractor shall complete said activities under Task 1 of this WA. In the event that all required project planing activities were completed and the project field sampling began in option period 3, Task 1 shall be ignored for work plan purposes as it is already complete.

Deliverable (if necessary): All necessary project planning activities including QAPP approval shall be completed by April 30, 2012.

Task 2: Execution of field sampling campaign and monthly reporting

Under the technical direction of the work assignment manager (WAM), the contractor shall execute the PS field sampling and analysis campaign for the Philadelphia project as specified in the approved QAPP. The field portion of the PS campaign including all contractor and subcontractor work shall be completed no later than March 31, 2014. As part of the Task 2, the contractor shall provide written monthly status reports in Microsoft Word 2007™ format including project progress, sample batch shipping and chain of custody tracking, and a discussion of encountered issues and proposed solutions. As part of the monthly status report, the contractor shall provide quality assured data packages in Microsoft Excell 2007™ format from combining all laboratory analysis for the project. The contractor shall participate in periodic calls with the WAM and the project team to review status and resolve issues as required.

Deliverable: Monthly report on field campaign delivery schedule

Report 1: April 30, 2013

Report 2: May 31, 2013

Report 3: June 28, 2013

Report 4: July 31, 2013

Report 5: August 30, 2013

Report 6: September 30, 2013

Report 7: October 31, 2013

Report 8: November 29, 2013

Report 9: December 30, 2013

Report 10: January 31, 2014

Report 11: February 28, 2014

Report 12: March 31, 2014

Task 3: Generation of Phase 2 QAPP and project arrangements

Under the technical direction of the WAM, the contractor shall initiate and complete the EPA QA Category 1 QAPP (see QA note) and all project planning deliverables for Phase 2 (including any necessary arrangements for potential subcontractors, deployment plans, safety plans, QAPP approval, etc.). The contractor shall participate in periodic calls with the project team to define all project and QAPP elements. Project planning and a QAPP appendix shall include base modeling efforts and software to determine the procedure for multipoint inverse model estimation of emissions form the observed facility using two week PS. This work shall build off of previously developed work in WA 3-63 on generic sources. The following details shall be assumed for project planning and QAPP development purposes.

- The passive sampler study shall assume ten (10) deployment locations (base set) immediately surrounding an oil and gas pond with twelve (12) PS samplers total including field blanks. A description of the site will be provided when available.
- The base set PS sampling height shall be assumed to be 1.5 m above the ground.
- For inverse modeling evaluation purposes, the base set of ten (10) locations shall be augmented by additional sampling locations at distances away from the fenceline (gradient approach) and also at vertical positions. (Distances and heights TBD).
- The PS deployment time shall be for two (2) weeks in duration for a period of six months and shall include the following expanded compound list:

1,2-Dichloro-1,1,2,2-tetrafluoroethane
1,3-Butadiene
Trichlorofluoromethane
1,1-Dichloroethene
1,1,2-Trichloro-1,2,2-trifluoroethane
1,1-Dichloroethane
cis-1,2-Dichloroethene
1,2-Dichloroethane
1,1,1-Trichloroethane
Benzene
Carbon tetrachloride
1,2-Dichloropropane
Trichloroethene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene

m,p-Xylene
Styrene
o-Xylene
4-Ethyltoluene
1,3,5-Trimethybenzene
m-Dichlorobenzene
p-Dichlorobenzene
o-Dichlorobenzene
Hexane

Note that Hexane is included in this list

- Analysis of PS to be performed by EPA laboratories
- Complete preparation and documentation of Qty 1, 3-D sonic based PID systems.
- EPA standard methods shall be deployed for comparison to the PSs.
- A technical systems audit shall be anticipated

Deliverable: Project Draft QAPP including inverse simulation and software to be delivered within 45 days of confirmation of site location.

Task 4: Execution of field sampling campaign and monthly reporting

Under the technical direction of the WAM, The contractor shall execute the PS field sampling and analysis campaign for the oil and gas project defined by the QAPP developed in Task 3. The field portion of the PS campaign including all contractors and subcontractor work shall be completed no later than March 31, 2014. As part of the Task 2, the contractor shall provide written monthly status reports in Microsoft Word 2007™ format including project progress, sample batch shipping and chain of custody tracking, and a discussion of encountered issues and proposed solutions, results of audits, etc. As part of the monthly status report, the contractor shall provide quality assured data packages in Microsoft Excell 2007™ format from combining all laboratory analysis for the project. The contractor shall participate in periodic calls with the WAM and the project team to review status and resolve issues as required.

Deliverable: Monthly reports on field campaign progress stating 30 days after initiation of field work and continuing for six months or until March 31st 2014.

ATTACHMENT #1
TO THE STATEMENT OF WORK (SOW)

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD:

☐ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

☐ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

Insert 01/22/13 (see QA note on Phase 1 and Phase 2 projects)

X **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

X **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and Application Projects**

☐ **QAPP Requirements for Software Development Projects**

X QAPP Requirements for Method Development Projects

☐ **QAPP Requirements for Design, Construction, and Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA=s Quality System Website: http://www.epa.gov/quality/
EPA=s Requirements and Guidance Documents:
http://www.epa.gov/quality/qa_docs.html

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used.

Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

4.5 Describe the method for uniquely numbering each sample.

4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-72

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Spray Foam Insulation Emission

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:
Please indicate initial "not to exceed" amount of $160 K.
Mark Mason

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
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4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Mark Mason (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4835 FAX Number: 919-541-2157
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates 3-27-13 (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Scope of Work
WA 4-72
Contract EP-C-09-027
Contract Option Period IV
Task Title

Spray Foam Insulation Emission Measurement Method Development

Section 1.0 Purpose

Spray polyurethane foam insulation (SPFI) is produced on-site by spraying a reactive mixture of isocyanates, polyols, amine catalysts, propellants, surfactants, flame retardants, and other compounds onto building surfaces. EPA, NIOSH, OSHA, the CPSC, and others are concerned about exposures of SPF applicators, building tradesmen, occupants, and bystanders to isocyanates, other SPFI reagents and reaction products during and after SPF insulation application. This project seeks to develop methods and data to characterize SPF emissions following application. A test method is needed by OPPT to support development of a TOSCA Section 4 rule requiring manufacturers to provide emissions data to EPA for their products. This data will assist EPA and other stakeholders in developing effective risk management strategies and for providing guidance regarding re-occupancy of buildings insulated with spray polyurethane foam.

The objectives of this project are to (Phase 1) develop and demonstrate methods to characterize the emissions from spray polyurethane foam (SPF) following application, during curing, and post curing, (Phase 2) characterize the emissions, and investigate the impact of environmental variables on multi-pollutant emissions from SPF. Outputs from the project will be (1) reports and peer reviewed journal articles that describe emissions characterization systems, elucidate emissions and impact of environmental variables on emissions, emission rates, and cure times, (2) input to stakeholder consensus test methods (e.g., ASTM) to enable stakeholders (SPF industry, emissions certification bodies, etc.) to evaluate product emissions and improve guidance, and (3) data for development and verification of models that relate emissions to potential exposure (see e.g., Z. Guo CSS Task 3-IAQ modeling).

The results from these experiments will provide reliable data that characterize the multi-pollutant emissions from SPF products and data that will provide information needed to support development of industry/stakeholder consensus test methods. The data will be valuable for NERL in exposure modeling, for OPPT, CPSC, and NIOSH for evaluation of data assessment and regulatory approaches. The results will be valuable to researchers at Yale who are developing biomarkers of exposure to isocyanates (Redlich, Wisnewski), and to Energy Star in establishment of performance requirements for insulation products.

Section 2.0 Background: Spray Polyurethane Foam (SPF) insulation products are used extensively to insulate building and seal air leakage pathways. Recent estimates place the number of buildings insulated in the U.S. with SPF insulation materials in the range of 70,000 to 100,000 per year. Because SPF products can be very effective in insulating buildings and reducing uncontrolled air leakage, SPF products have the potential to play an important role in reducing heating and cooling loads for buildings, a major source of energy consumption and green house gas emissions. SPF insulation is manufactured on-site using specialized equipment that mixes and blows SPF reagents onto target surfaces where, depending upon formulation and application, the reactants polymerize and expand to form either open or closed-cell foam. SPF is produced using two-component, high and low pressure systems, as well as one-component systems contained in spray cans that are used for sealing air pathways around plumbing and electrical penetrations, window and door frames. Reagent containers for two-component systems range in size from 55 gallon drums used by commercial applicators to one to five gallon containers for use in low-pressure systems employed by professionals and available to DYI homeowners. One component systems are widely available in hardware and building product stores and typically contain 16 to 32 oz. of SPF insulation reagent in aerosol spray cans.

The chemical constituents of two-component systems consist of "A" side and "B" side chemicals that are mixed in a chamber of the spray gun. "A" side components are reported to consist of a mixture of methylene diphenyl diisocyanate (MDI) and higher molecular oligomers of MDI (pMDI) whereas the "B" side contains proprietary mixtures of polyols, amine catalysts, blowing agents, surfactants, flame retardants, and propellants. When the product is applied, exothermic chemical reactions between "A" and "B" side components occur and the product expands rapidly to form open or closed cells. This initial expansion occurs within seconds or minutes of application. Additional reactions or curing may continue for an additional amount of time, e.g., 12 to 72 hours, depending upon formulation, substrate, and environmental conditions during application. Some SPF compounds are known sensory irritants and sensitizers, e.g., isocyanate exposure is considered to be the leading known cause of workplace-related asthma. Four isocyanates are included in EPA's list of 187 hazardous air pollutants (HAPs) and two isocyanates, toluene diphenyl diisiocyanate (TDI), and methylene diphenyl diisocyante (MDI) are listed on EPA's current priority action list. MDI irritates the eyes, irritates and sensitizes the respiratory tract and skin. Recently, MDI skin exposure has been shown to induce MDI-specific immune sensitivity and promote respiratory tract inflammation responses in animal systems. Pre-maternal exposure to isocyanates has been linked to increased risk of respiratory sensitivity in newborns. Amine catalysts may also cause respiratory tract, eye, and skin irritation and sensitization. Blowing agents may also irritate respiratory tract, eyes, and skin, and may have other central nervous system (CNS) effects. At least one of the flame retardants reportedly in use in SPF products has recently been listed as a Proposition 65 chemical in California.

Commercial applicators are required to utilize appropriate personal protective equipment (PPE) to prevent inhalation and dermal contact with isocyanates that are emitted in vapor and particulate phase during application of SPF insulation. Development of asthma has been linked to homeowners who reentered their home four hours after application of SPF insulation.(Tsuang and Huang, JOEM, Vol. 54, number 3, March 2012).Due to the increasing use of these products and reports of adverse health effects from some homeowners following installation of SPF insulation, there is a need for an improved understanding of the multi-pollutant emissions and exposures from SPF during application, curing, and post-curing and there is a critical need for improved understanding of the impact of environmental variables on emissions and cure time and movement of emissions from application site to inhabited spaces.

In April of 2011, under the authority of TSCA, EPA released action plans to address the potential health risks of methylene diphenyl diisocyante (MDI) and related compounds used in SPF and other consumer products that contain or are formulated with isocyanates, such as paints, caulks, sealants, and adhesives. Although EPA is receiving exposure and health effects data from industry, much of the data relating to unregulated polymeric MDI (pMDI) compounds, catalysts, and blowing agents are submitted as confidential business information (CBI), and little is known about aldehydes and other volatile organic compounds are formed and emitted as the product cures. Additionally, exposures due to consumer uses are poorly understood and the products are increasingly used in schools (e.g., one-component systems used in art projects) where young children may be exposed.

There are currently no consensus test methods, data, or models that characterize emissions from SPF products and relate emissions to potential exposure, hazard, and risk. Consequently, there is uncertainty regarding safe reentry time for building occupants following application of SPF and there are currently no test methods that can be used to generate reliable data on which to base decisions. There is also little data available that characterizes the transport within a building of gases and particles that are generated during SPF installation. Therefore, there are uncertainties regarding the sources of exposures

since they may be due to emissions generated during application as well as those that may be generated following application during the curing stage.

The lack of a test method that can be used to characterize post-application emissions from the product precludes development of understanding of (1) what compounds are emitted from SPF, (2) what is the time course of emissions, and (3) what key variables impact emissions? Although the overarching question "how long does it take SPF insulation to cure?" appears simple, providing an answer is not; SPF formulations are generally proprietary trade secrets, sampling and analyses methods for many of the compounds used in and potentially emitted from the product are complex, challenging, and/or in developmental stages. There is very little peer-reviewed public data available that characterizes emissions. Primary sources of data are from occupational exposure and health studies that focus primarily upon isocyanate emissions. Therefore, the first task is to develop a reliable method (or methods) to characterize emissions from SPF. This critical step is complicated by the fact that many of the key potential emissions are reactive and/or of low volatility. It is necessary to react isocyanates and amines with stabilizing agents upon sample collection to prevent degradation or polymerization on sample collection media. Thus, sampling and analysis for isocyanates and amines is complex and experimental systems must address the sorption of emissions by chamber and sampling system surfaces. Previous and current work-in progress suggests approaches to addressing these issues.

2.1 Previous related research: Wirts and Salthammer, 2002, and Wirts et. al., 2003, reported results from evaluation of isocyanate emissions including MDI emissions from polyurethane adhesives. Wirts characterized MDI emissions in a 2.2-liter chamber supplied with air at a flow rate of 1 L/min or 28 air changes per hour. In their system, a sampling filter was placed in the chamber 20 mm above the adhesive that had been applied to a substrate which was supported by a temperature controlled plate. Supply gas entering the chamber was pulled through the filter which was coated with a derivatizing agent. The authors conducted extensive investigations of variables that impacted emissions. However, they were not able to obtain comparable MDI emission rates when they scaled-up their chamber to a volume of 1 m^3. The authors speculated that wall effects and reactivity of MDI may have been responsible for inability to scale their emissions data. Note that the 2.2 L test system was purpose-designed to avoid these issues and the results were not expected to be comparable with test systems conforming to standardized emissions test guidelines such as ASTM D 5116 or ENV 13419.

2.2 Previous related research: Thomas Kelly, Battelle, 1996, Determination of Formaldehyde and Toluene Diisocyanate Emissions from Indoor Residential Sources. Final Report submitted to California EPA, Air Resources Board. Kelly and co-workers at Battelle investigated TDI emissions from selected consumer products in 9 L glass chambers. Screening tests were conducted at elevated temperatures (50 °C). One product that was demonstrated to emit TDI and was evaluated at room temperature in a manner designed to simulate actual use conditions. Concentrations were in the detectable range (>2 ppbv) for about one hour. A TDI vapor generation system was developed and sorption by chamber walls was evaluated. A sorption rate equivalent to 0.7 air changes per hour was calculated. Attempts to recover TDI from the chamber walls were not successful, however, and many other contaminants were observed. Kelly concluded that wall losses were not significant to the emissions characterization for this particular product and not likely worth additional effort that might be required to fully characterize and understand the interactions between emissions and chamber surfaces.

2.3 Previous related research: Skarping and Dalene have investigated isocyanate emissions from polyurethane products for over 30 years. The greater body of their work focuses upon occupational

exposure to isocyanates due to thermal processes that result in decomposition of polyurethanes and release of isocyanates leading to exposures to workers. Over this period of time they have developed, demonstrated, and commercialized sampling and analysis systems for isocyanates (ISO 17734-1), amines, aminoisocyanates (ISO 17734-2), and developed generation systems for creation of standard atmospheres in climate chambers to evaluate sampling and analysis systems, evaluated effectiveness of personal protective equipment (PPE), and investigated exposure and biomarkers. Skarping, Dalene, and co-workers have developed a source generation system to generate known atmospheres of many isocyanates including MDI, developed a denuder/filter sampling system to separate gas and particle phase MDI in air and developed an impactor sampling system to characterize size fractionated MDI particles. Recently, Skarping investigated emissions from polyurethane foam using a chamber manufactured from SPF and investigated wall losses to sampling lines and surfaces of the field and laboratory emission cell (FLEC). These unpublished experiments, conducted for the International Isocyanate Institute (III) demonstrated that conventional sampling systems and chambers are not suitable for characterization of MDI emissions from materials.

2.4 Current related research: CPI/BMS ASTM D22.05 Task WK 30960

The Center for Polyurethane Insulation (CPI) of the American Chemistry Council (ACC) initiated a task in the fall of 2010 to develop an ASTM Guide or Practice for emissions characterization from SPF using small environmental chambers. The work is conducted under the leadership of John Sebroski of Bayer Material Sciences (BMS) at the BMS facility located in Pittsburgh, Pennsylvania. The stated purpose for development of the method is to provide emissions information that can be used to support determination of safe re-entry following installation of SPF insulation. BMS/CPI has committed to preparation of several documents that would serve as components of a practice or guide for evaluation of emissions from SPF, including: (1)development of a surrogate SPF insulation materials for use in development and demonstration of a test method, (2) guide for preparation, packaging, shipping, and preparing for small chamber testing of SPF samples, (3) guide for sampling and analysis of MDI and pMDI by HPLC MS/MS, (4) guide for small chamber emissions characterization from SPF products, including MDI, pMDI, polyols, blowing agents, surfactants, propellants, and flame retardants, (5) guide for use of micro chambers to characterize emissions from SPF insulation samples. The BMS research updates are provided informally to ASTM D-22.05 and have not been reported in peer-reviewed literature. As of this writing, CPI and BMS have developed surrogate SPF insulation products for use in methods development and demonstration, and BMS has drafted and twice revised an ASTM draft guide for preparation, packaging, shipping, and prepping SPF insulation samples for chamber testing. Current BMS research includes investigation of packaging materials, laboratory hold times, and wall adsorption by micro-chamber and small chamber surfaces. Development of advanced analytical approaches (HPLC-MS/MS) awaits setup of new equipment.

Summary of preliminary findings to date as reported to ASTM D-22.05:

1. The surrogate SPF insulation products all appear to work in that they make foam.
2. Wall adsorption for classes of SPF constituents (MDI, pMDI, amine catalysts, flame retardant) are significant and vary between surfaces (Teflon, stainless steel) and are impacted by e.g., surface temperature, and chamber supply gas (dry nitrogen, humidified air).
3. Hold times of up to 48 hours (time between product formation and testing) in foil-lined Mylar bags sealed with aluminized tape are acceptable.

Observations regarding BMSCPI research and preliminary findings:

1. The CPI/BMS research is currently focused upon development and demonstration of a micro chamber and small chamber methodology for characterization of SPF insulation emissions. Micro

chambers have a depth of 25 mm, or one inch. Therefore they do not have the depth to accept a subsample from an SPFI sample that contains the entire core or depth for a sample that fills the depth of a typical stud wall with 3.5" depth (88.9 mm). However, the micro chamber could be used to evaluate emissions from different depths of a core.

2. Wall adsorption poses significant challenges to emissions measurement and characterization using chambers. It appears that sampling media must be positioned at the sample intake end of any transfer tubing, flow control, and sample pumps. The III currently has a project with Markes International to modify the micro chambers to improve recovery of isocyanates.
3. Chamber supply gas can significantly impact recovery of some compounds. For example, in the micro chamber system, recoveries of the flame retardant were in the 2 to 4% range until dry nitrogen supply gas was replaced with humidified air.
4. Chamber temperature may significantly impact recoveries of compounds. MDI recoveries improved as temperature of the micro-chambers increased from room temperature to 65 C.
5. Teflon surfaces appear to provide better recovery of some compounds (e.g., amines) as compared to stainless steel. It is not clear at this time if any one chamber surface, chamber size, or temperature is suitable for characterization of the range of compounds used in manufacture of the product.

The finding that hold times of up to 48 hours (time between product formation and testing) in foil-lined Mylar bags sealed with aluminized tape are acceptable may be premature since the emissions measurements have not been shown to be reliable for many key emissions.

2.5 Summary of previous and current research

There is consistency among studies that have attempted to characterize isocyanate emissions from products and materials. Chemical reactivity, sorption and reactions on sampling and chamber surfaces challenge attempts to quantify the time course of isocyanate emissions. These issues which challenge attempts to scale from one test system to another are particularly severe for isocyanates of low volatility such as MDI as well as other SPF SVOC constituents such as amines and flame retardants. Wirts' approach of placing the sample collection system in close proximity to the emission source and pulling all supply gas through the sampling filter permitted parametric evaluation of factors that impacted emissions of MDI from adhesives. This approach can likely be used to characterize emission of MDI from SPF insulation with a purpose-designed test system. However, methods to quantify wall sorption, gas-particle interaction, deposition, and chemical reactions will be needed to support use of emissions data to predict air concentrations in realistic environments.

2.5.1 Significant knowledge gaps and potential solutions:

- *Characterization of volatile non-reactive emissions*: Conventional chamber testing approaches have not been utilized and are likely to provide reliable information about volatile emissions during product curing for compounds such as alkanes, aromatics, formaldehyde, and acetaldehyde.
- *Characterization of semivolatile and reactive emissions*: The methods demonstrated by Wirts and Salthammer for measuring emissions of isocyanates from polyurethane products have not been applied to SPF insulation products. Development of a laboratory and field-deployable emissions test chamber specific to SPFI utilizing the basic concept demonstrated by Wirts and Salthammer could be used to address basic questions about isocyanate and amine emissions from SPF insulation.

- *Methods and data to link emissions tests in emissions cells and chambers to emissions in more realistic environments*: Significant research would be needed to characterize the air and surface interactions that have, to date, confounded emissions measurement and scale-up of isocyanate emissions derived from chamber tests. An argument can be made to conduct experiments that couple post-application phase emissions monitoring in for example, well-instrumented small-scale structures with emissions cell characterization of cure-phase emissions (based upon Wirts and Salthammer approach) to obtain insight into the relative importance of application and post application phase emissions of reactive compounds and explore correlation or lack of between emissions at the source and bulk air concentrations in the area of application.

2.6 Suggested approach for advancing emissions characterization for SPFI research:

An approach suggested by the work and findings to date is to develop a laboratory and field-deployable sampling system capable of collecting emissions in a laboratory or on-site from freshly manufactured SPF insulation. Such a system can be used to characterize the time-course of the difficult to characterize isocyanate and amine emissions from the product beginning at or soon after application through the curing phase. The system can be used in conjunction with area samples collected in the zone of application and at other locations within the building to provide insight into relationships between SPFI application, emissions, bulk air concentrations and transport. This approach, coupled with use of traditional chamber emissions testing for volatile emissions would provide a tool with which to address several important questions:

1. What isocyanate and amine compounds are emitted from SPFI formulations post application and for how long?
2. Do measurements of isocyanate and amine emissions determined in close proximity to the source provide insight into relationships between isocyanate and amine emissions and concentrations in bulk air?
3. How do environmental conditions of temperature and relative humidity, impact emissions of isocyanates and amines?

This approach does not by itself provide data that links source characteristics to potential exposures through source models and building simulations. That approach will likely require air and surface chemistry data for isocyanates and amines. However, correlations between emissions data generated with this type of tool and concentrations of emissions in e.g., small-scale test structures, test houses, and/or field sites has the potential to provide important insight into the relationships between application of SPFI and potential exposures, and evaluation of risk management strategies, including occupancy guidance. And, it does provide data and a key tool that can be used to design and conduct studies of air and surface interactions to support development of model parameters for use of chamber emissions data in exposure models.

Section 3.0 Task Descriptions

Key tasks that must be completed include: (1) development and demonstration of an emissions characterization system for measurement of reactive and semivolatile emissions from SPFI, with focus upon isocyanate and amine emissions, and (2) conduct of experiments that capture post-application phase emissions directly from the source using the emissions sampler developed in (1) as well as in conventional emissions test chambers, and in a test structure where the SPFI has been applied, and, (3) identification of the key processes (air and surface physical and chemical interactions) that link

emissions from the source to concentrations in indoor environments. Proof of concept experiments will be conducted to demonstrate the feasibility of this approach.

This project will be conducted in phases by EPA with the support of Arcadis contractor staff and as needed, expertise of subcontractors with specialized knowledge and facilities that are not available within EPA or Arcadis. The contractor shall provide sampling and analysis support through operation of analytical systems, provide high-level expertise in polyurethane material and emissions characterization through in-house and/or subcontract personnel, and provide engineering design, fabrication, and evaluation of prototype SPFI emissions test chambers/samplers. Descriptions for specific contractor tasks are described below. Task descriptions for tasks that are conducted by EPA personnel are provided in italics to facilitate planning and coordination of tasks.

3.1 Task 1: Provide sampling and analytical support through operation of in-house analytical systems and through subcontracts to qualified laboratories as needed to meet project goals. Although the initial focus of the project is to develop and demonstrate an emissions characterization system for isocyanate and amine emissions, the project will also evaluate the utility of conventional emissions chambers to characterize SPFI emissions. This will establish boundaries for use of conventional chambers to characterize SPFI emissions and may provide linkages between the prototype chambers developed specifically for isocyanate and amine emissions characterization and emissions determined in conventional emissions chambers and in more realistic environments.

3.1.1 LC MS/MS isocyanate and amine emissions characterization. (EPA task, Ken Krebs lead with technical support provided through in-house expertise or subcontractor) Extraction, concentration, LC MS/MS analysis of isocyanate and amine derivatives by LCMS/MS. The contractor shall provide technical support through in-house or subcontractor experts with demonstrated expertise in sample collection, preparation, identification and quantification of isocyanates and amines by LCMS/MS using dibutyl amine derivatization (ISO 17734-1, 17734-2).

In Option Period III, the contractor provided support to isocyanate sampling and analysis set up and demonstration, and development of validation test plans to establish method detection limits, precision and accuracy for the DBA sampling. The contractor will supply samples and supporting documentation for ASSET samplers loaded with gas-phase isocyanates (Phenyl isocyanate, 2, 4 and 2,6 Toluene diisocyanate) and particle-phase isocyanantes (Methylene diphenyldiisocyanate) in the current WA period.

3.1.1.1 This task will be completed in Option Period IV with a report that compares EPA results for analyses of the ASSET samplers loaded by the subcontractor with subcontractors' measurements of isocyanate loadings on the ASSET samplers. The contractor shall provide all information generated by the contractor and subcontractor to document isocyanate loadings on the filters that was not reported in Option Period III and assist EPA in evaluating and reporting results.

3.1.2 TD GC/MSD (Arcadis task) The contractor shall provide analytical support through operation of thermal desorption GC/MSD analyses of samples collected upon Tenax TA and Carbotrap adsorbents. Preliminary results of emissions characterization of SPFI by BMS/CPI indicate that many compounds emitted by SPFI can be quantified by conventional thermal desorption techniques. The contractor shall be responsible for procurement of standards, instrument calibration, maintenance, operation, data reduction, and reporting. The contractor shall be responsible for development and maintenance of SOPs and/or MOPs that may be required for QAPP test plans specific to this project.

EPA is currently developing test plans to conduct Task 4 experiments in the Option lV period in glass and/or stainless steel chambers. Sampling and analyses support, including development of MOPS and related QA documentation will be required from the contractor as detailed below.

3.1.2.1 The contractor shall provide TD GC/MSD VOC identification and quantification support for to up to 20 experiments described in Task 4. Compounds of interest shall be identified in consultation with the WAM in test plans. Numbers of tests conducted will depend upon resources available to the project.

3.1.2.2 The contractor shall investigate the recovery of semivolatile and reactive SPFl compounds of interest identified and quantified by TD/GC-MSD.

3.1.2.3 The contractor shall provide support to experiments that evaluate potential interferences from SPF emissions to quantification of analytes on interest collected on Tenax sampling and analysis systems, as needed.

3.1.3 GC/MSD with liquid injection (Arcadis task) The contractor shall provide analytical support through GC/MSD analyses of samples collected on XAD and/or PUF media. The contractor shall be responsible for sample collection, extraction, concentration, and analysis by GC/MSD. The contractor shall be responsible for procurement of standards, instrument calibration, maintenance, operation, data reduction, and reporting. The contractor shall be responsible for development and maintenance of SOPs and/or MOPs that may be required to document procedures for QAPP test plans specific to this project.

3.1.3.1 The contractor shall set up and calibrate a GC/MSD system to analyze TRIS flame retardants and selected amine catalysts and other compounds of interest that shall be identified in consultation with the WAM and identified in test plans.

3.1.3.2 The contractor shall provide sampling and analysis support for up to 20 experiments designed to characterize SPFl emissions using a well-mixed glass and/or stainless steel chambers. Numbers of samples and analytes of interest will be identified in test plans.

3.1.3.3 The contractor shall provide support to experiments that evaluate potential interferences from SPF emissions to quantification of analytes on interest collected on XAD or PUF sampling and analysis systems, as needed.

3.1.4 HPLC DA (Arcadis task) The Contractor shall provide analytical support through identification and quantification of aldehydes with DNPH sample collection and HPLC/DA analyses. The contractor shall be responsible for collection of samples, procurement of standards, instrument calibration, maintenance, operation, data reduction, and reporting. The contractor shall be responsible for development and maintenance of SOPs and/or MOPs that may be required for QAPP test plans specific to this project.

3.1.4.1 The contractor shall provide aldehyde sampling and analysis support for up to 20 Task 4 experiments designed to characterize SPFl emissions using a well-mixed glass and/or stainless steel chambers. Numbers of samples and analytes of interest will be identified in test plans.

3.1.4.2 The contractor shall provide DNPH/HPLC support to experiments that evaluate potential interferences from SPF emissions on DNPH aldehyde analysis systems, as needed.

3.2 Task 2: Design, develop and demonstrate an SPFI emissions chamber system. The contractor shall develop and demonstrate an SPFI emissions sampling system. The basic design goal is to create an emissions test chamber system for collection of isocyanate and amine compound emissions from SPFI where the test chamber does not impact the normal processes of cure and does not bias emissions of isocyanates and amines due to wall effects and chemical reactions in the chamber air. Key characteristics of the Wirts/Salthammer chamber were (1) temperature control of the sample substrate, (2) short travel time/distance between source and sampler, and (3) all chamber airflow was exhausted through the sample collection filter. For reference, in the Wirts/Salthammer 2.2 l emissions chamber, the distance between the surface of the PUR adhesive sample and derivatizing filter was 20 mm and the mean time for air to move the distance from the sample surface to the filter surface is estimated to be about 3 seconds. Target design criteria for the emissions test system are presented below.

3.2.1 Optimal design criteria for the SPFI isocyanate/amine emissions test system (PUFETS):

1. The PUFETS design allows height selection/adjustment to permit use with samples of varying heights. This may be accomplished through use of "base" units of varying depth that can be placed into a foam sample to which attaches a sampling head that places the sampling media a fixed distance from the surface of the SPFI.
2. The sample head accepts different types of sampling media, however flow characteristics at the surface of the sample should be similar (speed, turbulence).
3. Air flow enters the PUFETS radially near the sample surface and exits through the sample collection media located centrally above the surface.
4. The PUFETS should be, within practical limitations, thermally neutral with respect to the temperature environment of the sample. This requirement may impact dimensions and material choices.
5. The PUFETS is easily cleaned and does not emit organic contaminants.
6. The PUFETS may be used in two modes: a) open bottom where the lower edges of the base unit contact and seal to substrate materials expected in actual usage (e.g., sheetrock, wallboard, plywood) or and b) where the lower unit attaches to a bottom that isolates the SPFI from the immediate environment.

In Option Period III, the contractor created designs for three prototype polyurethane foam emissions test systems (PUFETS) and EPA selected the most promising design for further investigation. This design couples a commercially available sampling head (90 mm URG filter housing unit) to a custom-designed SPFI sample holder and air supply system. EPA has acquired two filter head assemblies and the contractor is scheduled to deliver a prototype of the complete system (filter head, sample holder, air distribution system) in Option Period III.

3.2.2 In Option Period IV, EPA will evaluate impact of the emissions test system on the physical processes that occur during the cure phase of SPFI. Exothermic chemical reactions occur during the curing of SPFI. It is important that the emissions test chamber shall not significantly impact the temperature regime of SPFI as it goes through the curing process. For a given SPFI sample, the EPA will compare temperatures at the base, midpoint, and surface of the SPFI sample over the cure-phase for samples placed in prototype chambers with temperature profiles obtained for SPFI insulation samples applied to realistic substrates (e.g., SPFI samples applied to wall section, rafter, or attic sub-assemblies).

EPA will evaluate flow characteristics, temperature control, and other factors that may impact the acceptability of the current design. In Option Period III, the contractor, in consultation with EPA, is

drafting test plans to investigate other factors that must be optimized for use of the sampler head in this application, specifically the use of 90 mm DBA treated filters in close proximity to an isocyanate emissions source.

3.2.2.1 In Option Period IV, the contractor shall evaluate and optimize the sampler design using controlled isocyanate emissions sources in a climate chamber.

3.2.2.2 The contractor shall provide engineering support for refinement of the PUFETS based upon results of optimization experiments described in 3.2.3.

3.2.3 The contractor shall: Optimize the performance of the PUFETS.

1. Determine the optimal distance between the top surface of the SPFI sample and the sample collection device (filter impregnated with derivatizing agent or other).
2. Optimize supply air inlet design to obtain indoor-representative air flow rate and turbulence levels at the surface of the SPFI.

3.2.4 The contractor shall demonstrate performance of the PUFETS utilizing independently calibrated isocyanate emissions sources in a climate chamber. This task will likely be conducted by a subcontractor with facilities and expertise in generation of MDI atmospheres in climate chambers.

3.2.4.1 The contractor shall conduct experiments to determine optimal sampling strategies that maximize sensitivity and time resolution for characterization of isocyanate emissions from SPFI using the PUFETS.

3.3 Task 3: Prepare samples for emissions testing (EPA task).
3.3.1 Obtain or construct a structure (e.g., storage building) for use as a spray booth and modify as follows:

- *Add ventilation fans and filters to enable controlled venting during and following SPFI application to test substrates.*
- *Add met tower outside of structure (temp. RH, BP, wind direction, speed, direction, solar radiation).*
- *Instrument inside building with temperature, RH BP sensors and data collection system.*
- *Cover interior with polyethylene sheet during foam spraying to manage overshoot.*

3.3.2 Obtain spray apparatus, training, develop proficiency in generation of SPFI of consistent depth.

- *Prepare samples as needed from high pressure and low pressure 2 component systems.*
- *Initial experiments will likely employ 2 component low pressure systems until arrangements are compete for use of high pressure systems.*

3.4 Task 4 Conduct proof of concept experiments. EPA will make foam using EPA acquired SPFI equipment and materials or through other arrangements with contactors and/or through collaboration with industry stakeholders. The contractor shall provide support through Task 1 analytical support activities for up to 20 Task 4 experiments in Option Period 4.

3.4.1 Proof of concept experiments will include experiments that evaluate the ability of the PUFETS system to sample SPFI emissions with minimal impact on curing process as indicated by comparison of temperature profiles during curing, time of curing and other physical indicators of cure state (industry standards to be determined) at standard laboratory conditions.

3.4.2 Proof of concept experiments will utilize the PUFETS, small chamber experiments, and experiments in small structures to evaluate the performance of the PUFETS, characterize the range of SPFI emissions, and investigate scale-up between systems.

3.5 Task 5 (new task, option period IV) Curing letter data review: The contractor shall review materials provided to EPA/OPPT by the chemical industry in response to the attached Task 5 SOW. The contractor shall obtain EPA clearance for confidential business information to perform this task and provide appropriate controls as necessary to meet regulatory requirements for managing CBI materials. The contractor shall read, review, sort, and provide comment on the relevance of submissions per the attached SOW specific to Task 5.

4.0 Reports

The contractor shall provide weekly verbal updates and written monthly progress reports per contract requirements, EP-C-09-027. The contractor shall provide the EPA work assignment manager (WAM) draft interim reports addressing items listed in task 1, 2 and 3 per the schedule below. It is expected that the time required to complete the project will extend beyond the period of performance of the current option period. The contractor shall provide engineering documentation for new test systems and modifications to existing facilities.
The contractor shall provide a draft final report that includes data, results, and analyses conducted by the contractor in option period IV per the schedule below. Requirements for reports, draft and final reports for Task 5 are provided in the attached document, "WA 4-72, Task 5".

4.1 Requirements for reports

The following are required for reports:

1. Two CDs with the content of each being identical.
2. The body of the report as a Microsoft Word document on each CD.
3. If there are appendices, or charts and tables grouped after main document, and cannot be included in the main document, they are to be included on each CD in their Microsoft format (Excel or Power Point files, for example).
4. If it is useful to have pictures on the cover of the report, the .jpg files should be included on the CDs as well as a description of what the layout is to look like. For multiple pictures, a hand drawn layout might be created with the name of the .jpg file and description of each picture in the layout. A hand-drawn layout can be converted to a pdf in APPCD's TIS office so it can be placed on the CD.

5.0 Schedule of Tasks, Reports, and Deliverables

5.1 The contractor shall submit draft and final reports per the schedule in the attached document: "WA 4-72, Task 5".
5.2 Option IV: Interim Reports: The contractor shall provide EPA WAM with data reports and data quality evaluations within two weeks of completion of each experiment (Tasks 1, 2, and 4).
5.3 The contractor shall provide final design drawings and specifications of PUFETS chamber systems in the draft final report.

5.4 The contractor shall submit a draft final report containing all interim data reports 45 days prior to the end of the Option IV period.
5.5 The contractor shall submit a revised final report within 15 days of receiving EPA review comments on the contractors draft final report.

6.0 Quality Assurance and Quality Control

A QAPP shall be prepared by the EPA WAM with support of the contractor. The contractor shall provide updated MOPs for 3.1.2, 3.1.3, and 3.1.4. Also, the contractor shall provide an addendum to the QAPP for supporting experiments conducted by subcontractors, e.g., 3.4.2. The contractor provided inputs to the draft QAPP. The contractor shall provide additional inputs as needed to support measurement activities not yet addressed in the current QAPP, specifically for HPLC/DNPH sampling and analyses, Tenax/thermal desorption/GC/MSD sampling and analyses, and XAD/PUF sampling/extraction/GC/MSD analyses. Note that MOPs and SOPs exist for most of these sampling and analyses activities or are under development for PUF/flame retardant sampling and analyses project.

7.0 Suggested Skills

Skills required for Tasks 1 and 4 include (1) ability to use gas chromatography/mass spectrometry for identification and quantification of organic compounds, including analysis of samples collected on solid sorbents for thermal desorption and samples collected on solid sorbents for liquid extraction followed by sample concentration techniques, (2) ability to use high performance liquid chromatography to identify and quantify aldehydes and ketones collected on DNPH cartridges, (3) ability to analyze, review, organize and report results, including review of quality assurance indicators. Skills required for Task 2 include: (1) ability to engineer, design, modify, construct novel sampling system specific to SPFl for collection of isocyanates and amines, (2) ability to measure/record temperatures in test systems. Skills required for Task 2 section 3.4.2, include ability to generate known air concentrations of MDl and other isocyanates emitted from SPFl (if identified) in the controlled environment of a climate chamber, ability to evaluate collection efficiency of prototype emissions sampling systems used to sample the standard atmospheres generated in a climate chamber. Skills and knowledge required for Task 5 include (1) ability to compile and organize information, and the ability to differentiate between publically available information and confidential business information and (2) basic understanding/familiarity of chemistry, emissions testing, and exposure assessment.

PERFORMANCE WORK STATEMENT
CONTRACT NO. EP-C-09-027

PERIOD OF PERFORMANCE: Option Year IV: April 1, 2013 to March 31, 2014

Background:

Diisocyanates are well known dermal and inhalation irritants and sensitizers and have been documented to cause asthma, lung damage, and in severe cases, fatal reactions in the work place. Worker exposures are subject to the use of protective controls, clothing, and equipment in occupational settings, but EPA is also concerned about potential health effects that may result from exposures to the consumer or self-employed worker while using products containing uncured (unreacted) Methylene Diphenyl Diisocyanate (MDI), Toluene Diisocyanate (TDI) and related polyisocyanate compounds or incidental exposures to the general population, including residents, while such products are used in or around buildings including homes or schools.

In 2011, EPA released Action Plans for MDI, TDI, and related compounds providing a screening-level review of hazard and exposure information, available online at:
http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/tdi.html,
http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/mdi.html.

As a follow-up activity, in September, 2012, EPA requested information, on a voluntary basis, from selected chemical manufacturers and processors relating to curing rates for polyurethane products intended to further react and thus undergo "curing" as part of their commercial use, such as use in adhesives, sealants, foams, and coatings. The curing rates for these types of products can affect the exposure potential for the chemicals used in these products or substances that may be formed as reaction products. We intend to use the submitted curing data as part of a quantitative exposure assessment. In this voluntary information request, EPA also requested data on aliphatic isocyanates, such as hexamethylene diisocyanate (HDI).

EPA specifically requested information from isocyanate manufacturers, including BASF, Bayer, DOW, and Huntsman, and product formulators, including Demelic, Fomo, Huntsman, Icyene, Idea Paint, and NCIF, relating to curing rates for polyurethane products intended to further react and thus undergo "curing" as part of their commercial use.

EPA requested the following information, if available, related to MDI, TDI, and HDI:
1. The curing time required to chemically react all diisocyanate functional groups.
2. The amount of time required, prior to and after a product has fully cured, to safely re-occupy or use an area where diisocyanates have been reacted (including expected exposures to diisocyanates, other formulation additives, and/or reaction products formed).
As presented in publicly available literature, MSDSs, and technical data sheets (TDS),

EPA recognized that there are varied interpretations of what "curing" means, such as definitions that incorporate performance and mechanical strength features. In the Action Plans, the Agency described curing as a completed chemical reaction when all of the initially free -N=C=O groups are bound within a polymer network. For this request, submitters were told that the term curing referred to the process that begins when monomers and/or reactants are initially combined and react until all available isocyanate groups fully react forming a final "fully cured" product. In a fully cured product no uncured (unreacted) isocyanate functional groups should be present. Thus, the curing time would be the time it takes to reach this fully cured state. Submitters were asked to provide the following associated information, as available, for any studies, memos, unpublished data, or other documents in their possession relating to curing time and re-occupancy:

- Product type *(e.g.,* coating, sealant) and intended final use *(e.g.,* floor coating).
- The chemical composition of the formulated products.
- Sensitivity analysis and associated supporting data showing variation in curing based on environmental conditions and other factors that influence curing such as ventilation rates, temperature, humidity, catalysts/reactants present, proportioning/mixing, application site (indoors or outdoors), quantity of product used, application method, and square footage covered.
- Methods and test data that show how the factors identified above influence specific curing times associated with each commercial/consumer product.
- The chemical levels measured and used to determine re-occupancy time, the exposure limits used in this determination (including occupational and general population limits), and the environmental conditions associated with this determination. Airborne concentrations of all diisocyanates and other chemicals that were measured and their respective concentrations over the duration of time required for full cure, including at full cure.
- Qualitative data *(e.g.,* surface wipe sampling) over time that indicate whether unreacted diisocyanate compounds were present on the surface of products or other hard and/or soft surfaces.
- Data related to all the stages before full cure as defined in this letter, outlined in MSDSs and TDSs as "tack free," "cuttable," "expansion time," "light traffic," or "ready for use," including a description of the product's state. This includes data showing that 90% or some other percentage of diisocyanates have reacted after a certain amount of time.
- Data related to the formation and identity of byproducts, particularly substances that continue to off-gas over time.

For studies that include data collection, submitters were asked to provide the laboratory analytical methods, instruments used for data collection/measurement, including all quality assurance/quality control measures, levels of detection or preferable levels of quantification, sampling times and strategy, and other experimental parameters used to measure isocyanates and spreadsheets or tables of the raw data.

Scope of Work:

Under the director of the Contracting Officer Representative (COR) for this task, the contractor shall provide technical support for the validation and analysis of information and data from the submitters and develop findings to be integrated into a quantitative exposure assessment. As specified in written technical direction by the COR under the specific task, the contractor shall provide the following technical assistance:

- review the quality, robustness, and completeness of the data, studies, and or reports submitted, including whether studies and reports adequately identified methods used, recognized methods protocol, and completeness of the information;
- provide a preliminary assessment whether the information and data received by the companies is responsive to EPA's request;
- provide feedback to the COR as to whether EPA should follow-up with the companies, as necessary, if the data provided was incomplete or not responsive to the request;
- create a report summarizing the data, reports, studies, and other information provided by the submitters on curing on polyurethane products; and, as relevant to the review of this information, provide additional observations and finding on polyurethane product curing and emissions that might impact indoor air quality, as well as potential exposures to workers, bystanders, or communities.

Tasks & Deliverables

The work assignment manager (WAM) will review all deliverables in draft form and request revisions and/or provide comments to the Contractor. The Contractor shall prepare the final deliverables, incorporating the WAM's comments.

Section 508 compliance requirements. All deliverables shall be in compliance with Section 508, Accessibility Standards of the Rehabilitation Act of 1973, and Amendments of 1998. When preparing deliverables, the Contractor shall refer to the most recent version of the 508 Standards at: **http://www.access-board.gov/sec508/guide/.**

Contractor personnel shall at all times identify themselves as Contractor employees and shall not present themselves as EPA employees. Furthermore, they shall not represent the views of the U.S. Government, EPA, or its employees. In addition, the Contractor shall not engage in inherently governmental activities, including but not limited to actual determination of EPA policy and preparation of documents on EPA letterhead.

Quality Assurance Requirements. The Contractor shall submit a written Quality Assurance Project Plan for any project that is developing environmental measurements, or a Quality Assurance Supplement to the Quality Management Plan for any project which generates

environmental data using models.

Confidential Business Information: the Contractor shall follow all requirements set forth under the Toxic Substances Control Act and as found at 40 CFR Part 2, Subpart B (see See 40 CFR 2.203(a), 41 FR 36902 (September 1, 1976) in the handling and review of confidential business information and in the development of summary reports/findings that refer to the data, reports, studies, and other information provided by the submitters.

Quality Assurance Requirements: The Contractor shall submit an addendum to the Quality Assurance Project Plan (QAPP)for WA 4-72 (QTRAK 12038/17794), in accomplishing this task.

Task #1: Review and Validation of Curing Data, Studies, Reports, and/or Other Information

The Contractor shall review the data, studies, reports, and other information and assess whether valid methods were identified and used and whether the information provided is complete, as well as responsive to EPA's request as described in the background.

Task#2: Feedback on Whether EPA Should Seek Additional Information and/or Clarification with Submitters

The Contractor shall also provide the COR with feedback on whether EPA should follow-up with the submitters to request additional information or clarification on the information submitted. Upon direction by the COR, the contractor shall be asked to participate in follow-up requests with individual submitters. By example, in other data reviews, EPA has asked submitters to provide additional information on the following:

The average values for the formaldehyde, amine catalysts, chlorobenzene, etc. were provided, please provide the raw data for the precision and range of values that were reported?

Does precision change dramatically between analytes and is the method only effective for some analytes?

In addition to precision, can you share data on the magnitude of the blanks, which were subtracted to give the reported results?

Please make additional related data and test methods used available, if not described and publically available.

According to the report, air samples were collected from the chamber up to day 20 for the open cell foam. Were formaldehyde or any other chemicals besides the amine catalyst measured and can you share the results?

Did the prescribed testing method work for any other analytes of concern?

You described that if air exchange rate is too low in the chamber, then the emissions are suppressed. If SPF is installed in a home with an air exchange at 0.3 or below, there may not be enough emissions at time of application, but once the HVAC system is operated and the air exchange goes up, can the emissions be

triggered at that time?

Even if this is quantitatively complex, are there qualitative considerations that can be made when considering occupant re-entry times?

How might you account for cumulative or long-term off-gassing?

You made the point that you accounted for all GCMS peaks. Please provide to what ratio and what range (or all ranges?).

Please clarify exactly which chemicals were measured and why.

Task #3: Draft Report

The Contractor shall develop and revise as necessary a draft report summarizing the data, reports, studies, and other information provided on curing on polyurethane products.

Task #4: Final Report

The Contractor shall revise the draft report as described in task 2 and, upon direction of the COR, provide a final report.

V. Deliverables:

The Contractor shall adhere to the following schedule.

Timing and Deliverables:

The period of performance is from April 1, 2013 to March 31, 2014.

Task	Deliverable	Schedule
Draft QA addendum	Draft QA addendum appropriate for compilation, review, and assessment of secondary data.	Submitted for review by EPA within 20 days of initiation of WA.
Task 1	Review & Validation of Curing Data, Studies, Reports, and Information of PU Product Curing.	Within 20 calendar days after receiving the data from COR or access through EPA Document Control Officer (DCO).
Task 2	Feedback on Additional Information and/or Clarification from Submitters	In unison with task 1, provide COR feedback within 20 calendar days after receipt of the information.

Task 3	Draft Report	Within 14 calendar days after review of the data, studies, reports, and other information or receipt of additional information/clarification from submitters as requested by the COR.
Task 4	Final Report	Within 14 calendar days after receipt of comments from the COR, following review of the draft report

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-73

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base X Option Period Number	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2014		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Emily Snyder (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-1006 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates 3-27-13 (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK

Contract EP-C-09-027

WA 4-73

PROJECT NUMBER C.2.2.4.01

U.S. ENVIRONMENTAL PROTECTION AGENCY

NATIONAL HOMELAND SECURITY RESEARCH CENTER

DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. TITLE

Decontamination Solution Methods for *Bacillus Anthracis* Surrogates

II. PERIOD OF PERFORMANCE

The period of performance for the tasks detailed in this Statement of Work (SOW) shall be from time of award until June 28th , 2013.

III. SUMMARY OF OBJECTIVES

This work will develop standard test methods for the evaluation of currently used decontamination solutions against *B. anthracis* simulants as applied to materials that are representative of personal protective equipment (PPE) or storage container materials containing forensic evidence.

IV. BACKGROUND

In the event of a chemical/biological incident, materials must be collected, preserved, and analyzed to conduct a successful investigation whether a crime has been committed. Such forensic analysis of evidence is often crucial to determinations of guilt or innocence. Collection of such evidence most likely will result in contamination of none-disposable PPE and equipment. Following the proper packaging of the evidence, the outside of (secondary) containers as well as none-disposable PPE

must be decontaminated. Efficacies of currently used decontamination solutions against toxic industrial chemicals (TICs) and pathogens are not always known. In addition, material compatibility of the contaminant and decontaminant must be determined.

Currently NHSRC is evaluating decontamination technologies against *B. anthracis* or its simulants as part of remediation operations. NHSRC has gained significant experience in decontamination technology testing and has the facilities and expertise to conduct such testing against *B. anthracis* surrogates. In this work, the efficacy of currently used decontamination solutions against these surrogates on various PPE related materials will be systematically evaluated. The effect of the decontaminant solution on the PPE materials will also be assessed qualitatively. This project addresses a direct need expressed by the Federal Bureau of Investigation (FBI)'s Hazardous Materials Science Response Unit (HMSRU).

V. SCOPE

The goals of this project are to provide responding agencies with information on material compatibility, and efficacies of currently used decontamination solutions against *B. anthracis* surrogates on materials/surfaces of interest. During Phase I (this WA), the emphasis will be on selected PPE and evidence container materials while future Phase II materials will be considered that make up the outer package of reusable equipment such as detectors. This second phase will also evaluate other parameters such as decontamination exposure time, amount applied, and application method on their influence of the efficacies. Many materials studied under this effort (specifically wood and stainless steel) are also pertinent to decontamination of civilian facilities.

In parallel with this WA, a second WA will exist in which the efficacy of the same decontamination solutions and same materials against toxic industrial chemicals will be investigated. Details of this study will be provided in the associated statement of work. The contractor shall make efforts to coordinate research activities across these two WAs.

VI. TECHNICAL APPROACH

Details for the general technical approach can be found in Section X. This effort will use a method employed in the previous option period, under WA-73, to test liquid spray decontamination solutions similar to how they would be used in the field for destruction of *B. anthracis* on building material surfaces. This effort incorporates a wider range of decontaminants on different surfaces than what was tested in the previous efforts. Neutralization and extraction methods were demonstrated under the previous option period for this work assignment. During the decontamination testing, the decontamination efficacy shall be determined for neutralization of specific combinations of surrogates/decontamination solutions from all materials. Material effects

shall also be visually assessed. A draft test/QA plan for these experiments was developed under the previous option period under WA-73.

VII. AFFORDABILITY

In comparison to the labor costs, only a small amount of expendable materials are required to be purchased by the contractor.

VIII. TECHNICAL RISK

The technical risk involved in this project is considered to be minimal. The goal is to provide information related to the efficacy of currently used decontamination methods against *B. anthracis* surrogate spores as present on PPE related materials. All information obtained is expected to be relevant.

IX. FACILITIES AND MATERIALS

All work on this project described in this statement of work shall be performed at the U.S. EPA's facilities located at 109 TW Alexander Dr, Research Triangle Park, NC. Decontamination testing is anticipated to be performed in a microbiology lab within the main EPA building.

X. TASKS

The contractor shall perform the following tasks as part of this work assignment:

TASK 3: EXECUTION OF PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION TESTING

The contractor shall examine the ability of Soap & Water (to be provided by EPA TOPO), pH amended Clorox Bleach (0.5 % NaClO), Dilute Clorox Bleach (0.5 % NaClO), Clorox Bleach (5 % NaClO), DF-200 (solution only), DF-200 foam/EasyDECON (foam), Reactive Skin Decontamination Lotion (RSDL), and SteriPlex Ultra (Bio Specific) to remove *B. stearothermophilus* from 18 mm diameter coupons of stainless steel, nitrile, butyl, viton, polyvinyl chloride, neoprene, and polyethylene. The contractor shall also examine the ability of Clorox Bleach (5 % NaClO), DF-200 (solution only), DF-200 foam/EasyDECON (foam), Reactive Skin Decontamination Lotion (RSDL), and SteriPlex Ultra (Bio Specific) to remove *B. stearothermophilus* from 18 mm diameter coupons of stainless steel, nitrile, butyl, viton, polyvinyl chloride, neoprene, and polyethylene. In this testing the contractor shall apply the decontaminant for 2 minutes to simulate the amount of

time that PPE would be sprayed down during decontamination. In addition to looking at removal efficacy, the contractor shall also qualitatively assess impacts of the decontaminant on the material (visual inspection).

The test matrix for this effort is shown in Table 1. Each test point corresponds to 5 test coupons, 2 positive controls, 1 procedural blank coupon, 2 negative control coupons and 1 laboratory blank. This test matrix will be repeated for each of the 7 materials listed above. After decontamination, the test coupons and procedural blank shall be neutralized and the viable spores shall be extracted from the coupons and enumerated. The rinsate from the 5 test coupons shall also be collected. Two aliquots of this rinsate shall be neutralized immediately after spray down and the viable spores in these aliquots shall be enumerated.

For each decontaminant-surface combination, the surfaces of the procedural blank and the positive control shall be visually inspected, conducting a side-by-side comparison of these two test surfaces before and after the 2 minute decontamination time. Any differences in the surfaces shall be notes and pictures shall be taken.

Table 2: Test matrix for decontamination solution testing.

Agent of Interest	Decontaminant							
	Soap & Water	pH amended Bleach (0.5 % NaClO)	Bleach (0.5 % NaClO)	Bleach (5 % NaClO)	DF-200 (solution only)	DF-200, EasyDECON (foam)	RSDL	SteriPl Ultra (Bio Specifi
Bacillus cereus				X	X	X	X	X
Bacillus stearothermophilus	X	X	X	X	X	X	X	X

DELIVERABLES:

1. The contractor shall provide monthly technical reports. These reports should also include summaries of all data generated during the month's activities.
2. The contractor shall transmit all data prior to the end of the option period. Raw and processed data shall be kept in Excel spreadsheets. The contractor shall transmit this data as soon as it has been internally reviewed for quality assurance.
3. The contractor shall have periodic meetings (once a month or more if needed) to discuss any technical difficulties and report progress.

NHSRC QUALITY ASSURANCE REQUIREMENTS FORM
Attachment 1 to the Statement of Work

I GENERAL INFORMATION

Title:	Decontamination Solution Methods for Bacillus Anthracis Surrogates
Description:	The goals of this project are to provide responding agencies with information on material compatibility, and efficacies of currently used decontamination solutions against B. anthracis surrogates on materials/surfaces of interest. During Phase I (this WA), the emphasis will be on selected PPE and evidence container materials while future Phase II materials will be considered that make up the outer package of reusable equipment such as detectors. This second phase will also evaluate other parameters such as decontamination exposure time, amount applied, and application method on their influence of the efficacies. Many materials studied under this effort (specifically wood and stainless steel) are also pertinent to decontamination of civilian facilities.
Project ID:	C.2.2
Status:	Original
Number Ammended:	
QA Category:	III
Action Type:	Extramural
Peer Review Category:	
Security Classification:	Unclassified
Project Type:	Sampling and Analysis; Applied Research
QAPP Status 1:	Not Delivered
QAPP Status 2:	Not Applicable
QAPP Status 3:	Not Applicable
Vehicle Status:	Existing Vehicle
Vehicle Type:	Vehicle Number: EP-C-09-027 Work Assignment Number: WA 3-73 Delivery/Task Order Number: NA Modification Number: NA Other: NA

*If you are processing an **IAG** or **CRADA**, the responsibility for QA must be negotiated within the agreement. The TLPs in consultation with the QAMs in the various organizations must agree on, and document, which organization will take the lead for QA, the names of the QAM and TLP from each organization, and the QA requirements that will be adhered to during the agreement. Include this info in the IAG/CRADA package.*

II SCOPE OF WORK

Yes Does the Statement of Work contain the appropriate QA language?

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with the R-2 and R-5 and/or the attachments provided with the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf

Yes Does this extramural action involve the collection, generation, use, and/or reporting of environmental data; the design, construction, and operation of environmental technologies; or development of software, models, or

methods?

(If "No" then skip to Section IV, and sign the form.)

No — Will the SOW or any subsequent work assignments or task orders involve any cross-organizational efforts within EPA?

N/A — Has a QAPP already been approved for the activities specified in the SOW?

Yes — Is an applicable QAPP in the process of being prepared, revised, or approved by EPA personnel for future use by the contractor? (QA approval must be obtained before the contractor can start work.)

Provide the expected title for submission to QA staff for approval:

Decontamination Solution Testing for Personal Protective Equipment and Related Materials Contaminated with Bacillus anthracis Surrogate Spores

Provide the approximate date for submission to QA staff for approval:

07/09/2012

III QA DOCUMENTATION OPTIONS

All documentation specified under "Other" must be defined in the NHSRC Quality Management Plan and be consistent with requirements defined in EPA Manual 5360 A1. For all items checked below, there must be adequate information in the SOW (or its appendices) for the offeror to develop this documentation. Where applicable, reference a specific section of the SOW. *(R-2 refers to EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, 03/20/01) and R-5 refers to EPA Requirements for Quality Assurance Project Plans (QA/R-5) (EPA/240/B-01/003, 03/20/01). Copies of these documents are available at http://www.epa.gov/quality/qa_docs.html.)*

After Award Documentation

R2	Documentation of an organization's Quality System. QMP developed in accordance with:
R2 and R5	Combined documentation of an organization's Quality System and application of QA and QC to the single project covered by the contract: Developed in accordance with:
R5	Documentation of the application of QA and QC activities to applicable project(s). Developed in accordance with:
	Programmatic QA Project Plan with supplements for each specific project, developed in accordance with:
Documentation developed pre-award	Existing documentation of the application of QA and QC activities will be used:

IV SIGNATURE BLOCK

The signatures below verify that the Statement of Work (SOW) has been reviewed to ascertain the necessary QA and QC activities required to comply with EPA Order 5360.1 A2, that the COR understands these requirements, and that the COR will ensure that the quality requirements indicated on the previous pages of this form are incorporated into all associated SOWs. *(Sign/date below, obtain a concurrence signature from the QA Staff, and submit the form along with the other extramural action documentation.)*

Emily Snyder NHSRC-DCMD Technical Lead Person	06/15/2012 Date	Eletha Roberts NHSRC-DCMD QA Staff Member	06/15/2012 Date

Ramona Sherman 6/20/2012

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-74

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Developing Remediation Tools a

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Emily Snyder (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-1006 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name: (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 3/21/13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK WA 4-74
Contract EP-C-09-027

PROJECT NUMBER C.2.2.3.02

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. TITLE

Developing Remediation Tools and Approaches to Address Indoor Contamination from the Misuse of Pesticides for Bed Bug Control

II. PERIOD OF PERFORMANCE

The period of performance for the tasks detailed in this Statement of Work (SOW) shall be from time of award until March 31, 2014.

III. SUMMARY OF OBJECTIVES

The first objective of this work is to perform solution-based laboratory-scale decontamination testing for other high priority pesticides (fipronil, permethrin,chlorfenapyr). The second objective of the work outlined in this effort is to determine the feasibility/efficacy of decontamination procedures (natural attenuation, repeat application of decontaminant, rinsing after application, and the use of steam cleaning) for remediation of surfaces contaminated by malathion and carbaryl on the pilot-scale. The chemical analysis for the solution-based testing is covered under this SOW. All necessary chemical analysis (by GC/MS or LC/MS/MS) for the pilot scale experiments is not covered in this SOW. This SOW does cover all of the sample preparation for these two objectives, consisting of the application of pesticides and application of decontamination procedures as well as determining pesticide residues on the surfaces through surface wipe sampling or coupon extraction.

IV. BACKGROUND

There has been an increase in reported pesticide misuse incidents for controlling bed bugs and other insects in indoor environments. These incidents include pesticide products not registered by the EPA for indoor use or approved pesticide products that are applied improperly or at concentrations that far exceed the labeled rates. The bed bug epidemic is expected to result in a growing number of incidents. EPA Regional Offices are often called on to assist local communities in remediating homes and businesses following indoor misapplications where pesticide levels may be unsafe. However, there are no tools for adequately evaluating pesticide residues on indoor surfaces to determine potential risk to occupants, and no effective cleaning procedures to reduce pesticide levels in affected structures. Therefore, occupants continue to inhabit contaminated buildings, or are forced to vacate contaminated properties, or attempt

decontamination themselves, which may create more toxic byproducts or further dispersing contamination. Pesticide manufacturers and the Office of Pesticide Programs offer little assistance when these products are applied illegally or in unintended ways.

The goal of this project is to provide responding agencies with information to evaluate indoor pesticide misuse incidents and reduce occupant exposures. This includes appropriate surface sampling protocols and guidance on safe concentrations for selected pesticides on various indoor surfaces to determine remediation needs and to evaluate the effectiveness of cleaning efforts. It will also generate safe, effective decontamination procedures to reduce exposure risk to building occupants without creating toxic by-products. This is not only a regional need, but also a national one as expressed in the issue paper presented to EPA by the State FIFRA Issues Research and Evaluation Group (SFIREG) at its June 2011 meeting.

V. SCOPE

The scope of this WA is to perform the solution and pilot scale decontamination tests and complete the experimental work necessary to generate the pilot-scale extracts (from the wipes). The scope of this WA is also to perform analysis of the laboratory-scale coupon extracts and transfer the wipe extracts from the pilot-scale coupon extracts to the appropriate labs for analysis.

VI. TECHNICAL APPROACH

Details for the general technical approach can be found in Section X. The contractor shall conduct initial solution based testing for four potential decontaminants representing a range of reaction chemistries to determine their efficacy against fipronil, permethrin, and chlorfenapyr. The contractor shall also, building upon previous work under WA 3-74, test natural attenuation, repeat application of a decontaminant, rinsing the decontaminant after application, and steam cleaning for neutralization or removal of malathion and carbaryl from two to three materials (see Section X for details). The presence of toxic decontamination by-product malaoxon will also be confirmed (semiquantitative analysis of malaoxon- no additional experimental work required by the contractor). A draft test/QA plan for these experiments will be provided by the EPA WAM prior to commencement. This test/QA plan shall be finalized by the contractor.

VII. AFFORDABILITY

In comparison to the labor costs, only a minimal amount of expendable materials are required to be purchased by the contractor.

VIII. TECHNICAL RISK

The technical risk involved in this project is considered to be minimal. The goals of this work are to: 1) provide a preliminary screening of decontaminants for fipronil, permethrin, and chlorfenapyr ; and, 2) provide a pilot scale assessment of decontamination strategies. All information obtained is expected to be relevant.

IX. FACILITIES AND MATERIALS

All work on this project described in this statement of work shall be performed at the U.S. EPA's facilities located at 109 TW Alexander Dr, Research Triangle Park, NC. Decontamination testing is anticipated to be performed in a chemical hood in H-224 while chemical analyses of the pilot scale samples are expected to occur in E-352A and D484-A, but are not covered under this SOW. The facility for analysis of the laboratory-scale extracts shall be determined by the contractor.

X. TASKS

The contractor shall perform the following tasks as part of this work assignment:

TASK 1. PREPARATION OF MATERIALS

The contractor shall prepare coupons from the materials shown in Table 1 to complete the method development and decontamination testing as described in Tasks 3-5.

Table 1: Building material sample specifications.

Material	Description	Coupon Surface Size L x W (inch)
Stainless Steel	SS 304 Grade as used in e.g. kitchen sinks	14.0 x 14.0 inches
Vinyl Flooring	12" x 36" floating vinyl tile; residential grade, stain resistant, scratch resistant; thickness will be measured	14.0 x 14.0 inches
Latex based painted wallboard	Standard sheet rock painted with premium latex paint in white thickness will be measured	14.0 x 14.0 inches

TASK 2. DEVELOPMENT OF THE QAPP

The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The EPA WAM, in concert with the project team, will prepare a draft QAPP (likely an amendment to an existing QAPP) in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf and the NHSRC Quality Assurance (QA) requirement as defined in Attachment #2 to the SOW. A draft of the

QAPP will be provided for comments to the contractor before review by the EPA Quality Assurance Manager. The contractor and EPA WAM shall respond to comments and submit the QAPP for approval to the EPA Quality Assurance Manager. The QAPP, including any amendments, shall be approved by the U.S. EPA in writing (e.g., signature on the approval page) prior to the start of any work. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

TASK 3. COMPLETION OF PILOT-SCALE TESTING OF SINGLE APPLICATION OF DECONTAMINANT

After the coupons are contaminated with the carbaryl, using a pipette and the template used previously for this WA, the coupons shall be allowed to sit for 30 minutes to allow the surface to dry. The decontaminant shall be applied to an individual coupon that is sitting in the horizontal orientation using a Meterjet Spray Gun (Rittenhouse, St. Catharines, ON).

The decontaminant shall not be neutralized instead after 4 hours has past (allowing the decontaminant to dry) the surface shall be wiped and extracted to determine the amount of remaining pesticide. The surface wipe and extraction procedure is outlined in the approved QAPP "Developing Remediation Tools and Approaches to Address Indoor Contamination from the Misuse of Pesticides for Bed Bug Control". Because both pesticides are persistent the parallel positive controls will allow for decontamination efficacy to be calculated.

Each test matrix point shall include 3 test coupon replicates for each decontaminant and 2 positive control replicates and 3 extraction control coupons (which each generate 2 wipes that are extracted together). A procedural blank coupon shall also be included. This coupon shall not be contaminated but shall otherwise be taken through the same procedures as the test coupons. This coupon will also generate 2 wipes that shall be extracted together. A table of the overall test matrix is shown below in Table 2. Half of the carbaryl extracts shall be sent to Jim Starr in D484-A for LC/MS/MS analysis and half shall undergo toxicity analysis (see paragraph below). See Task 6 for specifics on how these extracts are to be delivered.

Table 2: Test matrix for Task 3 pilot scale testing.

Pesticide	Material	Coupons without decontamination	Decontaminant	Coupons with decontamination
Carbaryl	Stainless Steel	2 positive control, 3 extraction control coupons	A	3 test coupons, 1 procedural blank coupon
			B	3 test coupons, 1 procedural blank coupon
	Vinyl Flooring	2 positive control, 3 extraction control coupons	A	3 test coupons, 1 procedural blank coupon
			B	3 test coupons, 1 procedural blank coupon
	Latex Painted Wallboard	2 positive control, 3 extraction control coupons	A	3 test coupons, 1 procedural blank coupon
			B	3 test coupons, 1 procedural blank coupon

A standard human acetylcholinesterase assay shall be used for the carbaryl extracts. Sample shall be diluted in water to a final concentration of 5.0% DMSO and then tested in the bioassay with a second dilution to a final concentration of 0.5% DMSO. Samples shall be tested in duplicate. Appropriate positive and negative controls on the testing plate shall be included. Test samples showing inhibitory activity against acetylcholinesterase shall be requested to be retested using a concentration-response format. Appropriate testing range shall be determined based on all available information (% inhibition of the single concentration testing, analytical results determining amount of carbaryl extracted), typically 6 concentrations with half-log dilutions. A standard curve using known concentrations of carbaryl shall provide a limit of detection analysis (100 M high concentration, half-log dilutions, 8 concentrations).

The contractor shall provide toxicity analysis 39 extracts provided by the EPA WAM. A standard human acetylcholinesterase assay shall be used for the malathion extracts. This assay requires the addition of a metabolic activation step. Samples shall be diluted in buffer to a final concentration of 1.0% DMSO and including 5% S9

homogenate prepared from the livers of Aroclor 1254-induced Sprague-Dawley male rats obtained commercially from Molecular Toxicology, Boone, NC; 4 mM NADPH; 5 mM glucose-6-phosphate; and salts. Following overnight incubation, the microtiter plates will be centrifuged for 1 hour at 2,500 X G and supernatant removed for testing in the bioassay. A second dilution of the bioassay shall result in a final concentration of 0.5% DMSO. Samples shall be tested in duplicate. Appropriate positive and negative controls shall be included on the testing plate according to their SOP. Test samples showing inhibitory activity against acetylcholinesterase shall be requested to be retested using a concentration-response format. Appropriate testing range shall be determined based on all available information (% inhibition of the single concentration testing, analytical results determining amount of malathion extracted), typically 6 concentrations with half-log dilutions. A standard curve using known concentrations of malathion with S9 treatment shall provide a limit of detection analysis (100 M high concentration, half-log dilutions, 8 concentrations).

TASK 4. SOLUTION-BASED DECONTAMINATION TESTING

The contractor shall conduct a series of solution-based decontamination tests on fipronil, permethrin, and chlorfenapyr. These experiments shall be completed using neat agent and each agent-decontaminant test will generate 4 total solutions (1 positive control solution, 3 test solutions). Four decontaminants will be tested for each pesticide and these decontaminants shall be determined by the EPA WAM in concert with the project team. The extracts from this testing shall be analyzed by the contractor at appropriate laboratories.

TASK 5. PILOT SCALE TESTING OF DECONTAMINATION METHODOLOGIES

Large, 14"x14", coupons of the materials described in Task 1 will be contaminated with the pesticide (malathion or carbaryl), using a pipette and the template developed under WA-3-26. Prior to any of the testing outlined below, the coupons shall be allowed to sit for 30 minutes to allow the pesticide solvent to evaporate.

Task 5a Natural Attenuation: A single set of malathion- or carbaryl-contaminated coupons (set of 3) will be placed into a environmental chamber with RH and temperature monitoring and control. These coupons will be removed after a set period of time and immediately wipe sampled using protocols developed and outlined in the QAPP "Developing Remediation Tools and Approaches to Address Indoor Contamination from the Misuse of Pesticides for Bed Bug Control". This will be repeated for two pesticide-material combinations at two different environmental conditions. The test matrix is shown in Table 3.

Table 3. Test matrix for natural attenuation testing.

Pesticide	Material	Environmental Condition							
		TBD by EPA WAM				TBD by EPA WAM			
Malathion	Hard Surface (Stainless Steel)	t_1	t_2	t_3	t_4	t_1	t_2	t_3	t_4
Carbaryl	Hard Surface (Stainless Steel)	t_1	t_2	t_3	t_4	t_1	t_2	t_3	t_4

Task 5b: Repeat Application of Decontaminant

For this subtask only the stainless steel, vinyl flooring, and latex painted wallboard materials shall be studied. After the pesticide is applied and the solvent is allowed to dry a decontaminant (TBD by EPA WAM - based upon results from WA-3-74) shall be applied to an individual coupon that is sitting in the horizontal orientation using a Meterjet Spray Gun (Rittenhouse, St. Catharines, ON).

After no more than two hours have elapsed (do not allow the decontaminant to dry), the same decontaminant will be applied again to the surface and then allowed to dry. The surface shall then be wiped to determine the amount of remaining pesticide. No neutralization of remaining decontaminant shall occur prior to wiping of the surface. Wipe sampling and analysis protocols outlined in the QAPP "Developing Remediation Tools and Approaches to Address Indoor Contamination from the Misuse of Pesticides for Bed Bug Control" will be used. Because both pesticides are persistent the parallel positive controls will allow for decontamination efficacy to be calculated.

Each test matrix point shall include 3 test coupon replicates for each decontaminant and 2 positive control replicates and 3 extraction control coupons (which each generate 2 wipes that are extracted together). Extraction controls are where contaminated coupons that are immediately wiped to determine the wipe extraction efficiency. A procedural blank coupon shall also be included. This coupon shall not be contaminated but shall otherwise be taken through the same procedures as the test coupons. This coupon will also generate 2 wipes that shall be extracted together. A table of the overall test matrix is shown below. In addition to this test matrix a series of wipe sampling controls will be prepared and extracted for the pilot scale testing. These include: pre-cleaned wipes blank media (1 per test day), and the 3 positive control wipes (wipes spiked with analyte and extracted – 1 set per test day). The malathion extracts shall be sent to Dennis Tabor in E-352A for GC/MS analysis and the carbaryl extracts shall be sent to Jim Starr in D484-A for LC/MS/MS analysis. See Task 6 for specifics on how these extracts are to be delivered. Table 2 outlines the test matrix for this part of Task 5.

Task 5c: Application of Rinse after Decontamination

For this subtask only the stainless steel, vinyl flooring, and latex painted wallboard materials shall be studied. After the pesticide is applied and the solvent is allowed to dry a decontaminant (TBD by EPA WAM - based upon results from WA-74) shall be applied to an individual coupon that is sitting in the horizontal orientation using a Meterjet Spray Gun (Rittenhouse, St. Catharines, ON).

After 30 minutes the decontaminant will be rinsed off of the surface using a separate spray gun. The surface shall then be wiped to determine the amount of remaining pesticide. No neutralization of remaining decontaminant shall occur prior to wiping of the surface. Wipe sampling and analysis protocols outlined in the QAPP "Developing Remediation Tools and Approaches to Address Indoor Contamination from the Misuse of Pesticides for Bed Bug Control" will be used. Because both pesticides are persistent the parallel positive controls will allow for decontamination efficacy to be calculated.

Each test matrix point shall include 3 test coupon replicates for each decontaminant and 2 positive control replicates and 3 extraction control coupons (which each generate 2 wipes that are extracted together). Extraction controls are where contaminated coupons that are immediately wiped to determine the wipe extraction efficiency. A procedural blank coupon shall also be included. This coupon shall not be contaminated but shall otherwise be taken through the same procedures as the test coupons. This coupon will also generate 2 wipes that shall be extracted together. A table of the overall test matrix is shown below. In addition to this test matrix a series of wipe sampling controls will be prepared and extracted for the pilot scale testing. These include: pre-cleaned wipes straight from the storage jar (1 per test day), and the 3 positive control wipes (wipes spiked with analyte and extracted – 1 set per test day). The malathion extracts shall be sent to Dennis Tabor in E-352A for GC/MS analysis and the carbaryl extracts shall be sent to Jim Starr in D484-A for LC/MS/MS analysis. See Task 6 for specifics on how these extracts are to be delivered. Table 2 outlines the test matrix for this part of Task 5.

Task 5d: Determination of Steam Cleaner Removal Efficiency

For this subtask only the stainless steel and vinyl flooring materials shall be studied. After the pesticide is applied and the solvent is allowed to dry a steam cleaner (to be provided by EPA WAM) will be applied to the coupon. The contractor shall develop a procedure representative of how the steam cleaner would be deployed in the field in concert with the EPA WAM and the project team. After steam cleaning, the surface shall then be wiped to determine the amount of remaining pesticide. Wipe sampling and analysis protocols outlined in the QAPP "Developing Remediation Tools and Approaches to Address Indoor Contamination from the Misuse of Pesticides for Bed Bug Control" will be used. Because both pesticides are persistent the parallel positive controls will allow for decontamination efficacy to be calculated.

Each test matrix point shall include 3 test coupon replicates for each decontaminant and 2 positive control replicates and 3 extraction control coupons (which each

generate 2 wipes that are extracted together). Extraction controls are where contaminated coupons that are immediately wiped to determine the wipe extraction efficiency. A procedural blank coupon shall also be included. This coupon shall not be contaminated but shall otherwise be taken through the same procedures as the test coupons. This coupon will also generate 2 wipes that shall be extracted together. A table of the overall test matrix is shown below. In addition to this test matrix a series of wipe sampling controls will be prepared and extracted for the pilot scale testing. These include: pre-cleaned wipes straight from the storage jar (1 per test day), and the 3 positive control wipes (wipes spiked with analyte and extracted – 1 set per test day). The malathion extracts shall be sent to Dennis Tabor in E-352A for GC/MS analysis and the carbaryl extracts shall be sent to Jim Starr in D484-A for LC/MS/MS analysis. See Task 6 for specifics on how these extracts are to be delivered. Table 4 outlines the test matrix for this part of Task 5.

Table 4: Test matrix for Task 5 pilot scale decontamination testing.

Pesticide	Material	Coupons without decontamination	Decontamination Procedure	Coupons with decontamination
Malathion	Stainless Steel	2 positive control, 3 extraction control coupons	Repeat application of decontaminant	3 test coupons, 1 procedural blank coupon
			Rinsing after application of decontaminant	3 test coupons, 1 procedural blank coupon
			Application of steam cleaner	3 test coupons, 1 procedural blank coupon
	Vinyl Flooring	2 positive control, 3 extraction control coupons	Repeat application of decontaminant	3 test coupons, 1 procedural blank coupon
			Rinsing after application of decontaminant	3 test coupons, 1 procedural blank coupon
			Application of steam cleaner	3 test control coupons, 1 procedural blank coupon
	Latex Painted Wallboard	2 positive control, 3 extraction control coupons	Repeat application of decontaminant	3 test coupons, 1 procedural blank coupon
			Rinsing after application of decontaminant	3 test coupons, 1 procedural blank coupon
			Application of steam cleaner	3 test coupons, 1 procedural blank coupon
Carbaryl	Stainless Steel	2 positive control, 3 extraction control coupons	Repeat application of decontaminant	3 test coupons, 1 procedural blank coupon
			Rinsing after application of decontaminant	3 test coupons, 1 procedural blank coupon
			Application of steam cleaner	3 test coupons, 1 procedural blank coupon
	Vinyl Flooring	2 positive control, 3 extraction control coupons	Repeat application of decontaminant	3 test coupons, 1 procedural blank coupon
			Rinsing after application of decontaminant	3 test coupons, 1 procedural blank coupon

			Application of steam cleaner	3 test coupons, 1 procedural blank coupon
	Latex Painted Wallboard	2 positive control, 3 extraction control coupons	Repeat application of decontaminant	3 test coupons, 1 procedural blank coupon
			Rinsing after application of decontaminant	3 test coupons, 1 procedural blank coupon
			Application of steam cleaner	3 test coupons, 1 procedural blank coupon

TASK 6: ANALYTICAL SUPPORT

Under this task the contractor shall dry down all of the carbaryl LC/MS/MS extracts that are balanced in hexane as outlined in the QAPP "Developing Remediation Tools and Approaches to Address Indoor Contamination from the Misuse of Pesticides for Bed Bug Control". The contractor shall also prepare instrument detection limit standards (10) and calibration standards (5 per pesticide) for both GC/MS and LC/MS/MS of the pilot-scale samples. The specifications for these standards shall be provided by the EPA WAM. The contractor shall also add the internal standards (provided by the EPA WAM) to all of the vials that will be analyzed by GC/MS or LC/MS/MS prior to delivering them to the analytical laboratory.

XI. DELIVERABLE SCHEDULE

On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, cumulative financial expenditures and cost and schedule variance. The contractor shall also have bi-weekly meetings with the EPA WAM and the project team for the duration of the WA.

The deliverables in the form of experimental details and extracts are shown in Table 3.

Table 3: Deliverable Schedule

Task Number	Deliverable	Due Date
1	Complete Coupon Preparation	1 month from award of this WA
2	Comments Related to Review of Draft QAPP or Amended QAPP	1 month from award of this WA

3	Generate Extracts from Pilot Scale Testing	2 month from award of this WA
4	Generate Extracts from Solution Based Decontamination Testing	3 month from award of this WA
4	Concentrations of Pesticides from Solution Based Decontamination Testing	4 month from award of this WA
3	Results from Toxicity Based Assay	7 months from award of this WA
5	Generate Extracts from Pilot Scale Testing	January 30th , 2013

XII. REPORTING REQUIREMENTS

- Data related to this project shall be stored on the US EPA server's DTRL shared drive. Electronic data for this WA should be minimal but may include titration data for decontamination solutions.
- Transfer of project data shall occur at the conclusion of each experiment within each task. Detailed written summaries of experimental procedures and results shall be provided to the WAM within one week from completion of the data analysis. These reports shall indicate the operational conditions (e.g. decontamination solution preparation procedure and exposure time)

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-75

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Health Impact Assessment (HIA)

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Clyde Owens (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-1133 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates 4-11-13 (Signature) (Date)		Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

Project Work Statement
Technical Services for a Building Systems Evaluation: In support of a Health Impact Assessment and Building Assessment in a Springfield, MA Community Elementary School to Evaluate Proposed Remediation Scenarios for Indoor Sources and Near Roadway Transportation Exposures

I. TITLE

Health Impact Assessment (HIA) and building assessment in a Springfield, MA Community Elementary School to evaluate proposed remediation scenarios for indoor sources and near roadway transportation exposures

II. PERIOD OF PERFORMANCE

The period of performance for this work assignment shall be from the date of award to September 30, 2013.

III. SUMMARY OF OBJECTIVES

The primary objective of the full project is a developed HIA that examines the health, environmental, and economic impacts of the Springfield, MA Community Elementary School. Another objective is producing tools and approaches to conduct HIAs that other communities can use for sustainable solutions and to generalize lessons learned regarding prioritizing school repairs. A portion of the full HIA project is to provide data and information to be used to prioritize renovations and repairs based on impacts on health. This specified portion is to integrate a building systems approach into the school contractors' work on specific building problems such as water leakage and HVAC performance. This comprehensive evaluation of the building systems will provide data to be used in the HIA to prioritize repairs based on impacts on health.

IV. RELEVANCE

The National Risk Management Research Laboratory (NRMRL) / Air Pollution Prevention and Control Division (APPCD) has an active indoor air research program that includes characterization and evaluation of remediation approaches. This research topic is actively supported by the Office of Research and Development (ORD) and specifically the Sustainable, Healthy Communities research area.

V. BACKGROUND

The City of Springfield, MA is an environmental justice community and a focus of the Pioneer Valley Geographic Initiative within Region 1's coordinated communities program. The German Gerena Community School was built over 30 years ago in a Hispanic neighborhood that was split in two by the construction of the Interstate 91. The school was constructed partially beneath an I-91overpass with a community tunnel pathway/mall, swimming pool and community center within the school connecting the two neighborhoods. Over time, the school and its community linkage areas have deteriorated due to fires, floods, vandalism, water intrusion and vibration from the highway and rail line. It has extremely high maintenance for multiple storm sewage and water pumps and HVAC systems. Springfield is one of MA's 5 hotspots for high pediatric asthma rates. In the 2007-2008 reporting from school nurses to MA Department of Public Health, Gerena's 760 students had a 21.3% prevalence rate compared to the state's average rate of 10.8%. EPA has been working closely with the Pioneer Valley Asthma Coalition to reduce asthma severity in the area and assisting the Dept. of Parks and Buildings (PBRM) to evaluate IAQ and energy efficiency in the schools. The City is

already heavily involved in remedial action at the school to address issues of poor or inadequate ventilation and moisture and mold, and has recently proposed to spend over $2M in renovation projects related to air intakes close to the highway deck, air intakes adjacent to freight rail lines at a distance of < 50 meters, and moisture getting inside the school in several areas. The community and city stakeholders have requested EPA support to understand which renovations could be most successful in reducing health impacts, considering total costs and benefits. Region 1 is interested in extending previous efforts in Springfield, and in integrating health impact assessment into the PBRM's assessment of repairs and their costs, in collaboration with ORD.

VI. SCOPE

This technical portion of the project will integrate a building system approach with the work of the school and its contractors in investigating problems in the building operations and examining proposed remediation scenarios. This specific work will then be incorporated into scenarios within the Health Impact Assessment of the stakeholders and school staff at German Gerena Community School in Springfield, MA. The scoping step requires participation and input of the stakeholders to incorporate their concerns regarding the school's status and environmental problems.

VII. TECHNICAL APPROACH

This statement of work requires an inter-disciplinary approach to assess, develop, and evaluate issues related to the environmental problems of the schools and proposed remediation and repairs. The technical approach will involve use of building sciences and systems approach that also integrates indoor air quality field work. The contractor will use the best practices as developed in EPA, NIOSH and US Dept of Energy handbooks and manuals on building air quality and moisture control. This comprehensive, diagnostic building system services will provide consultation services with EPA staff and with the Springfield Dept of Parks, Buildings and Recreation management. The consultation will require working with ongoing service companies, with school services and other agencies assisting the Springfield Dept of Parks… on evaluating Gerena School. The contractor will not repeat the work of the other services but will verify their findings and perform diagnosis tests when necessary. The contractor may perform tests and perform forensic investigation on moisture and water intrusion in the tunnel and school spaces. The necessary forensic diagnostics may require evaluation of pressure differentials through the buildings and tunnels. This may require the Contractor(s) to conduct qualitative research, quantitative analysis, modeling and database management; and technical assistance on subject areas that include, but are not limited to, the following areas:

1. <u>Environmental Impacts</u>

- Environmental impacts (air, water, climate, land) on the structure alternatives
- Environmental impacts (air, water, climate, land) of construction techniques and practices
- Storm water and ground water impacts on the infrastructure

- Energy efficiency and climate impacts of building technologies and design, community design, and infrastructure
- Strategies for climate protection and their associated requirements on building
- Strategies for improving air quality and their associated requirements on building

2. **Health**
   - Community design and children's health
   - Building material health impacts
   - Health impacts of different infrastructure and transportation alternatives
   - Public health impacts of transportation and community design
   - Indoor air quality
   - Public health impacts of different transportation systems, including car and freight traffic

3. **Diagnosis evaluations and evaluations of suggested remediations**
   - Through understanding of ongoing phase I evaluation of the building by the Dept of Parks contractors and integration with their work prior to diagnosis walk through
   - Work with EPA staff and contractors to evaluate major sources of pollution within and near the structures
   - Evaluation of suggested remediations for the known environmental problems
   - Proposed remediations for any newly diagnostic problems

VIII. TASKS

The Contractor(s) shall provide technical support in the following areas: All policy options or recommendations developed by the Contractor shall be subject to Agency review and approval. The Agency will have the final determination regarding any recommendations developed by the Contractor(s).

VIII. A. Field Work Assessment and Integration with Previous Phase I Contractors

The research analysis needs of EPA fall generally into the following subcategories, which are described in detail below: Qualitative Research, Quantitative Analysis, Integration, and Report Summary and Recommendations

VIII.A.1. Qualitative Research, Quantitative Analysis, and Integration

Initially, it is expected that the contractor will thoroughly familiarize himself with the complete phase I Investigation Report of the school prepared by the Architect Timothy Murphy and consultants as well as reports provided by the Springfield Dept. of Parks.

Qualitative Research and Quantitative Analysis. The Contractor(s) shall use tools and techniques which are commonly accepted in the fields of building systems sciences and moisture control remediation, testing, and inspection. To measure continuous relative humidity and temperature, the contractor shall position sensors throughout the building and monitor seasonally to capture potential HVAC changes and their impacts on indoor relative humidity and heating during cooling and heating. Pressure differentials and air flow tests will be utilized and other relevant air flow diagnosis will be performed and interpreted.

I. Complete Visual Mold Inspection

The Contractor(s) shall perform a visual inspection for the initial step in identifying all possible mold contamination problems within the building. The extent of any water damage and mold growth shall be visually assessed by the contractor. This assessment is important to determine remedial strategies. Ventilation systems shall also be visually inspected, particularly for damp filters but also for damp conditions elsewhere in the system, and for overall cleanliness. Ceiling tiles, gypsum wallboard (sheetrock), cardboard, paper and other cellulosic surfaces shall be given careful attention during a visual inspection. The Contractor(s) shall use hygrometers, a boroscope (fiber optics) and a protimiter (moisture meter), where necessary, to detect hidden moisture and mold behind the walls, ceilings and floors and to determine the areas of potential mold growth and continuing moisture penetration.

II. Random Sampling for mold, conducted using EPA's Method

The Contractor(s) shall assist EPA's scientists in collecting random samples of mold using the ORD developed methodology. A duster will be used to sample random surfaces, collected and shipped to ORD for analysis.

III. Air Pressure and air flow diagnosis

In order to understand the operation of the buildings and tunnels as an operating system, diagnosis shall be performed to determine air flows within the spaces. These air pressure differentials tests will aid in evaluating unplanned air flows that might be spreading pollutants or defeating the effective operation of the heating and ventilation system. Also, dehumidification will be evaluated in all areas of the building as a method to correct moisture problems although energy efficiency impacts will also be examined. Particular attention will be paid to unplanned air flows into student occupied spaces.

A building envelope air leakage test shall be performed according to, and by investigators experienced with, US Army Corp of Engineers Air Leakage Protocol for Building Envelopes, V3, dated May 11, 2012. In conjunction with the air leakage tests, leaks in the building envelope shall be identified using infrared thermography methods by the same investigators as the air leakage test. The lead thermographer shall have successfully completed a course of study that complies with Level I and Level II requirements of the American Society for Nondestructive Testing as described in SNT-

TC-1A-2006 and ANS/ASNT CP-105, Training Outlines for Qualification of Nondestructive Personnel, and shall have a minimum of two years of experience using this protocol.

IV. Air Monitoring

The contractor may perform some air sampling, mainly focused on indoor sources of pollution, such as re-entry of combustion sources. If there are any observed or noticeable indoor sources of pollution such as the swimming pool chemicals, monitoring may be necessary to determine the exposure levels. The Contractor(s) shall implement means and methods to protect the integrity of the indoor air quality by developing an efficient approach of protection for following areas; Pollutant Source Control, HVAC Equipment and Systems, Air Cleaning, and Exposure Control. The HVAC system can act as a source of contaminants by providing a hospitable environment for the growth and by then distributing contaminated air within the building. After identifying or removal of contaminant source, i.e. presence of mold or other indoor pollutants (VOCs), air monitoring shall be necessary to improve the maintenance of HVAC ventilation systems that have been contaminated.

In the current effort, the Contractor shall provide continuous monitoring equipment (capable of reporting 1 minute integrated values) associated with fine particulate matter, gaseous nitrogen dioxide, PM2.5 black carbon, particle counts, and meteorological conditions (wind speed, wind direction, relative humidity, temperature) associated with one indoor school location and one outdoor school location on the school property. The Contractor shall prepare, position, operate, and maintain monitoring equipment followed by validating and providing to EPA said database in an EPA-approved format. The Contractor is not required to do any data summarization beyond providing data quality commentary as needed for EPA to interpret data for inclusion on a subsequent air quality assessment. The Contractor shall provide to the EPA a cost estimate for the proposed field campaign including the cost of any equipment needing to be acquired or leased and specifics concerning any particular monitoring instrumentation (measurement) that results in total equipment costs exceeding a value of $8000. The Contractor shall provide cost estimates associated with a two week (Monday-Friday) data collection period and a one month (Monday-Friday) data collection period. The two week period shall be considered the base and the one month estimate shall be reported as an option to be considered by EPA. All field data collections must be completed no later than February 28th, 2013 with validated databases released to EPA no later than March 30th, 2013.

The Contractor shall use (amend) a previously developed QAPP to support this new effort. The WA COR will communicate to the Contractor the existing QAPP for such amendment. As such, the amended QAPP shall be edited as necessary and provided to EPA for approval prior to the initiation of any and all field monitoring. Instrumentation operating procedures, relying heavily on manufacturer's guidelines (directions) shall be developed for EPA approval.

Table 1 lists the proposed environmental measures for the work assignment

Table 1. Proposed Study Design Features of the RESES 1 effort

PM 2.5 Mass (nephelometry)	I, O
NO_2	I, O
PM particle counts	I, O
Black carbon (aethalometry)	I, O
Meteorology (WS, WD, temperature, RH)	I, O (windspeed and wind direction only at outdoor location)

I = school indoors, O = school outdoors

SUBTASK(S)):

The contractor shall provide the appropriate technical support for conducting the RESES 1 field campaign as outlined above. The WA COR will provide to the Contractor the RESES 1 study design which may be used in the Contractor's base understanding on the goals and overall approach of the full effort.

The Contractor shall initiate the field sampling and data collection and fully completed it no later than February 28, 2013. All of the validated environmental data shall be provided to the EPA in an EPA specified format (as specified in the QAPP) no later than 30 days following the final collection day. It is permissible for the Contractor to release partial (one week) datasets during the field campaign if it so chooses rather than a single (complete) dataset at the end of the monitoring effort.

The contractor shall provide the following technical support:

Sub-Task 1. Make provision for the needed equipment and field monitoring staff to conduct a limited environmental assessment in Springfield, MA.

Sub-Task 2. Revise and finalize an existing Quality Assurance Project Plan to reflect the contractor's quality systems organization, framework, programs, policies, and resources. This includes developing any needed standard operating procedures (SOPs) associated with the Contractor's activities.

Sub-Task 3. Conduct a continuous (Monday-Friday) environmental assessment using portable indoor and outdoor monitoring instrumentation. One minute integrated time units should be the base interval but 5-minute integrated time units may be conducted upon the approval of the WA COR. A two week field campaign is the minimum measurement period (base) while an optional one month period will be performed if the WA COR approves this option. The

Contractor shall establish, operate, and maintain all equipment (and needed supplies) during the field campaign. Because of the location of the monitoring, the Contractor shall obtain permission to be on school property prior to all visits and report in to the school's office as required by all visitors. Proper photo identification must be available for all field staff and on their person while on school grounds. The WA COR will work with the Contractor and a list of all staff expected to be on school property shall be provided to the school to facilitate access.

Sub-Task 4. The Contractor shall validate all environmental data and provide to the EPA an approved database no later than March 1, 2013.

VIII.A.2. Data Management

Data Management. The Contractor(s) shall create, manage and update spreadsheets or databases relevant to the research regarding the building systems and indoor air quality investigations and evaluation of the school and remediations. The Contractor(s) shall provide databases with capabilities for database linkage and easy updating, revision, and transfer of data. Such spreadsheets or databases shall be developed for wide distribution or use by other EPA offices and regions, the general public, and other partners.

The Contractor(s) shall provide legends and clear labeling of tables in data analyses to fully document the data collection and analysis methodology/assumptions. As specified in the Work Assignment, deliverables (including interim products) shall be given to the government in Microsoft Excel format (or other software compatible with the EPA's systems). The Contractor(s) shall convert data files from larger Statistical Analysis Software (SAS) or Statistical Product Service Solution (SPSS) models to a compatible format (e.g., Excel).

VIII. B. TECHNICAL ASSISTANCE

The Contractor(s) shall assist other contractual staff in supporting technical assistance programs or projects sponsored by key partners (EPA program and regional offices, local and state government, and non-profit organizations). Technical assistance efforts will include any effort to build capacity in a local, regional or state entity to implement strategies related to construction, development, infrastructure (water, sewer, utilities, and transportation networks), and planning issues that result in improved environmental, health, economic, fiscal and social impacts. The activities conducted under this task include but are not limited to:

- Integration and evaluation of previous contractors' Phase I work which include assessments of operating systems and suggestions of remediations.
- Developing new recommendations for remediations of environmental problems and offering options for strengthening of acceptance of proposed remediations

- Providing technical support in written and oral details after walk throughs and for all technical school team meetings as identified by the WAM or WAM designee
- Developing materials in preparation and support for technical assistance efforts
- Providing assistance with preparations for community engagement

VIII. C. COMMUNICATION AND OUTREACH

As directed by EPA, the Contractor(s) shall generate reports with observations, results, conclusions and recommendations related to the environmental problems of the school and proposed remediations. The contractor(s) shall communicate findings and reports solely with the EPA Work Assignment Manager or their designee. Communication efforts may include, but are not limited to, publications and reports:

1) Publications: The Contractor(s) shall prepare drafts and then a print ready copy of the document in the required format, for publication on EPA's website, in professional journals, trade press, and/or online as a web page according to the WAM's documented technical direction.
2) Reports: The Contractor(s) shall provide EPA with various research, evaluation and analytical reports; option papers, recommendations, and proposals; minutes, summaries, and findings from meetings; internet and electronic data base and information inventories.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-76

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base X Option Period Number	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Sangdon Lee (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4531 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates 3-27-13 (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK
Contract EP-C-09-027

I. TITLE
Parametric testing of decontamination chemistries to guide decontamination selection I: peracetic acid

II. PERIOD OF PERFORMANCE
The period of performance for the contract shall be from the date of award till 3/31/2013.

III. SUMMARY OF OBJECTIVES
This work will provide a test plan for the use of peracetic acid solution as a *B. anthracis* spore decontamination agent on different materials and under varied environmental conditions.

IV. RELEVANCE
This project will test key parameters to decontaminate *B. anthracis* spores using peracetic acid solution. This study will identify the degrees of effects from various parameters on decontamination using peracetic acid.

V. BACKGROUND
Protecting human health and the environment from the release of hazardous materials is the mission of US Environmental Protection Agency (EPA). EPA's National Homeland Security Research Center (NHSRC) Decontamination Consequence Management Division (DCMD) has developed a systematic decontamination research program to fulfill this mission. This project will test key parameters to decontaminate *B. anthracis* spores using peracetic acid as decontamination agent.

A parametric study of potential *B. anthracis* inactivation agents would be beneficial for numerous building interiors for effective decontamination under various environmental conditions. Results from this project will be used to provide the EPA Office of Emergency Management (OEM) bio-decontamination information to be used during remediation efforts.

VI. SCOPE
The technical objective of this project is to test key parameters to decontaminate *B. anthracis* spores using peracetic acid. The test results will determine the impact of parameters on *B. anthracis* spore inactivation efficacy using peracetic acid solution. Sufficient replicates, blanks, and positive controls shall be used, consistent with standard

microbiological and quality assurance procedures, past work conducted by the contractor, and studies being currently conducted by the contractor.

VII. TECHNICAL APPROACH

Peracetic acid solution shall be used to inactivate *B. anthracis* surrogate spores under various test conditions. The test conditions shall include various types of surfaces, concentration of peracetic acid solution, temperature, spore loading levels, etc. The test condition and measurement details will be determined later by EPA WAM. Varied concentrations of surrogate spores shall be deposited onto the target surface materials via both liquid inoculation and aerosolization. The tests shall be conducted in the indoor testing chamber at EPA with controlled relative humidity and temperature. All experiments shall be approved by the EPA work assignment manager (WAM) prior to commencement. Test and analytical methods shall be adopted from past or on-going efforts, in consultation with the WAM.

VIII. TASKS

TASK 1. PREPARATION OF TEST/QA PLAN

The contractor shall prepare a Quality Assurance Project Plan (QAPP) in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. This QAPP shall include a comprehensive work plan and a timetable for completion of the work. The QAPP, in addition to providing data quality objectives and indicators, will provide details on the test matrix, test methods and measurements as well as a project schedule. The contractor shall have meetings with the EPA WAM before preparing Test/QA plan. The EPA WAM will provide the test conditions including but not limited to the following parameters: surrogate spore type, surface types, testing surface size, spore loading levels, surface sampling methods, testing chamber environment, temperature, relative humidity, peracetic acid concentration, and reaction time. The QAPP shall be submitted to the EPA WAM within 45 days of award of the work assignment and the plan shall be approved by the EPA QA officer prior to work.

IX. QUALITY ASSURANCE

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The contractor shall prepare a QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.

X. DELIVERABLE SCHEDULE

Task	Deliverable	Completion Date
1. QA/Test plan	QAPP	45 days of award of the work assignment

NHSRC QUALITY ASSURANCE REQUIREMENTS FORM
Attachment 1 to the Statement of Work

I GENERAL INFORMATION

Title:	Parametric testing of decontamination chemistries to guide decontamination selection I: peracetic acid
Description:	This project will test key parameters to decontaminate B. anthracis spores using peracetic acid solution. This study will identify the degrees of effects from various parameters on decontamination using peracetic acid.
Project ID:	C.2.3.1
Status:	Original
Number Ammended:	
QA Category:	IV
Action Type:	Extramural
Peer Review Category:	III; IV
Security Classification:	Unclassified
Project Type:	Applied Research; Basic Research
QAPP Status 1:	Not Delivered
Vehicle Status:	Existing Vehicle
Vehicle Type:	EP-C-09-027
	Work Assignment Number: 3-76
	Delivery/Task Order Number: N/A
	Modification Number: N/A
	Other: N/a

*If you are processing an **IAG** or **CRADA**, the responsibility for QA must be negotiated within the agreement. The TLPs in consultation with the QAMs in the various organizations must agree on, and document, which organization will take the lead for QA, the names of the QAM and TLP from each organization, and the QA requirements that will be adhered to during the agreement. Include this info in the IAG/CRADA package.*

II SCOPE OF WORK

Yes Does the Statement of Work contain the appropriate QA language?

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with the R-2 and R-5 and/or the attachments provided with the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf

No Does this extramural action involve the collection, generation, use, and/or reporting of environmental data; the design, construction, and operation of environmental technologies; or development of software, models, or methods?

(If "No" then skip to Section IV, and sign the form.)

III QA DOCUMENTATION OPTIONS

In order for extramural actions that involve collection, generation, use, and/or reporting of environmental data; the design, construction, and operation of environmental technologies; or development of software, models, or methods, Quality Assurance (QA) requirements are applicable. Proceed to Section IV and sign the form.

IV SIGNATURE BLOCK

The signatures below verify that the Statement of Work (SOW) has been reviewed to ascertain the necessary QA and QC activities required to comply with EPA Order 5360.1 A2, that the COR understands these requirements, and that the COR will ensure that the quality requirements indicated on the previous pages of this form are incorporated into all associated SOWs. *(Sign/date below, obtain a concurrence signature from the QA Staff, and submit the form along with the other extramural action documentation.)*

Sangdon Lee NHSRC-DCMD Technical Lead Person	01/10/2013 Date	Ramona Sherman NHSRC-IO QA Staff Member	01/10/2013 Date

QAPP REQUIREMENTS FOR APPLIED RESEARCH PROJECTS

(from Appendix B of the NHSRC QMP)

An applied research project is a study to demonstrate the performance of technologies under defined conditions. These studies are often pilot- or field-scale. The following requirements should be addressed as applicable

SECTION 0.0, APPROVAL BY PROJECT PARTICIPANTS

The EPA Technical Lead Person (TLP) shall be responsible for obtaining signatures of appropriate project participants on the signature page of the QA plan, documenting agreement to project objectives and the approach for evaluating these objectives.

A distribution list shall be provided to facilitate the distribution of the most recent current version of the QAPP to all the principal project participants.

SECTION 1.0, PROJECT DESCRIPTION AND OBJECTIVES

1.1 The purpose of study shall be clearly stated.

1.2 The process, site, facility, and/or environmental system to be tested shall be described.

1.3 Project objectives shall be clearly stated and identified as primary or non-primary.

SECTION 2.0, PROJECT ORGANIZATION

2.1 Key points of contact for each organization involved in the project shall be identified.

2.2 All QA Managers and their relationship in the organizations (*i.e.*, location within each organization) shall be identified with evidence that the QA Manager is independent of project management.

2.3 Responsibilities of all other project participants and their relationship to other project participants shall be identified meaning that organizations responsible for planning, coordination, sample collection, sample custody, measurements (*i.e.*, analytical, physical, and process), data reduction, data validation, and report preparation shall be clearly identified.

SECTION 3.0, EXPERIMENTAL APPROACH

3.1 The general approach and the test conditions for each experimental phase shall be provided. The statistical methods that will be used to evaluate the data (*i.e.*, ANOVA, or summary statistics) should be identified.

(NOTE: As deemed appropriate to the project by the TLP, the information requested in Sections 3.2, 3.3, and 3.4 may be presented here or in Section 4; the information requested in Sections 3.5 may be presented here or in Section 5; and the information requested in Sections 3.6 may be presented here or in Section 7.)

3.2 The sampling strategy shall be included and evidence must be presented to demonstrate that the strategy is appropriate for meeting primary project objectives, *i.e.*, a description of the statistical method or scientific rationale used to select sample sites and number of samples shall be provided.

3.3 Sampling/monitoring points for all measurements (*i.e.*, including locations and access points) shall be identified.

3.4 The frequency of sampling/monitoring events, as well as the numbers for each sample type and/or location shall be provided, including QC and reserve samples.

IV SIGNATURE BLOCK

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EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-77

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base X Option Period Number	DECONTAMINATION LINE PROTOCOL

Contractor	Specify Section and paragraph of Contract SOW
ARCADIS U.S., INC.	Section 2

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	OCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Shannon Serre (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3817 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature)	5-14-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK

DECONTAMINATION LINE PROTOCOL EVALUATION FOR BIOLOGICAL CONTAMINATION INCIDENTS

DCMD C.2.3.1.07
(APPCD ON-SITE CONTRACT EP-C-09-027, WA 4-77)

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

TABLE OF CONTENTS

I. TITLE

Decontamination Line Protocol Evaluation for Biological Contamination Incidents

II. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be Award – 3/31/14.

III. SUMMARY OF OBJECTIVES

This work will examine the different stages/steps in the decon line and the effectiveness of each stage in preventing cross contamination of individuals or outside areas.

IV. RELEVANCE

The purpose of the decontamination line is to assure that any potentially harmful or dangerous residues, on persons or equipment are confined within the Hot Zone. The decontamination line is intended to prevent the spread of contaminants beyond the already contaminated area, including to other personnel and other environments. Information from this study can be used to determine the effectiveness of the current configuration or provide additional suggestions for improvement.

V. BACKGROUND

Under Homeland Security Presidential Directive (HSPD) 10, the U.S. Department of Homeland Security (DHS) is tasked to coordinate with other appropriate Federal departments and agencies, to develop comprehensive plans which, "provide for seamless, coordinated Federal, state, local, and international responses to a biological attack." As part of these plans, the U.S. Environmental Protection Agency (EPA), in a coordinated effort with DHS, is responsible for "developing strategies, guidelines, and plans for decontamination of persons, equipment, and facilities" to mitigate the risks of contamination following a biological weapons attack.

EPA's National Homeland Security Research Center (NHSRC) provides expertise and products that can be widely used to prevent, prepare for, and recover from public health and environmental emergencies arising from terrorist threats and incidents. NHSRC's Decontamination and Consequence Management Division (DCMD)'s decontamination research program's goal is to provides expertise and guidance on the selection and implementation of decontamination methods and provide the scientific basis for a significant reduction in the time and cost of decontamination events.

NHSRC works with EPA's Office of Emergency Management's (OEM) Emergency Response Technical Group (ERTG). The ERTG group is comprised of members from each of the EPA's 10 Regions as well as members from each of the special teams. The ERTG compiled the long term decontamination line procedure that will be evaluated as part of this project.

VI. SCOPE

The purpose of this study is to determine the effectiveness of each stage in the decontamination line procedure in preventing cross contamination of individuals or outside areas.

VII. TECHNICAL APPROACH

The contractor, upon approval from the EPA WAM, shall procure all test equipment and materials to be included in this project. The contractor shall work with the EPA WAM to develop the Quality Assurance Project Plan (QAPP) and test plan. The EPA WAM will assemble a team of EPA employees that will assist in the development of this project and provide feedback on the progress.

VIII. AFFORDABILITY

This effort is labor intensive, which is where the bulk of the funding is required. The contractor shall procure all test materials/equipment. It is expected that a decontamination tent will be provided by EPA's OEM. The rest of the materials and equipment shall be purchased under this work assignment. The work is expected to be conducted at EPA's Research Triangle Park Facility.

IX. TECHNICAL RISK

The technical risk involved in this project is minimal. The ultimate goal is to determine which steps in the decontamination line process are effective in controlling the spread of biological organisms.

X. FACILITIES AND MATERIALS

All experimental efforts shall be performed by the contractor at the U.S. EPA's facilities located on the U.S. EPA campus in Research Triangle Park, NC. The decontamination line tent will be provided by EPA's OEM.

XI. TASKS

The work to complete the tasks listed below shall be conducted at NHSRC/DCMD's facilities located on EPA's Research Triangle Park, NC campus. The deliverable dates and availability of vendor-supplied equipment shall be used by the contractor work assignment leader (WAL), in consultation with the EPA WAM, to determine the testing schedules.

The following tasks are defined as part of this work assignment:

Task 1 – Preparation of Work Assignment Work Plan

A detailed Work Plan is due 20 calendar days after receipt of the approved Work Assignment. Content shall be in accordance with terms and conditions of the contract.

Task 2 – Develop the QAPP/Test Plan

A test/quality assurance plan shall be developed in accordance with EPA Guidelines for Preparation of Quality Assurance Project Plans (QAPP) and NHSRC Quality Management Plan (QMP). The test/QA plan shall detail roles/responsibilities, experimental methods, quality assurance/quality control measures, and data management and analysis procedures. A draft test/QA plan shall be provided to EPA for review. Upon receipt of EPA review comments, a revised test/QA shall be prepared for EPA QA and peer review. EPA QA and peer review comments shall be incorporated into the final test/QA plan. No data collection shall begin until the QAPP is approved by the EPA COR.

The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this work assignment (see Attachment #1 to the SOW) and the NHSRC QA requirement as defined in Attachment #2 to the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

The contractor shall work with EPA WAM to develop a test plan that will evaluate the decontamination line procedure that is included as Attachment A to this SOW.

Task 3 – Determination of Test Materials and Test Matrix

The contractor shall determine any test materials and equipment that are required to complete this work assignment. The list of materials shall be approved by the EPA WAM prior to purchase.

Task 4 – Evaluation of the Decontamination Line Procedure

The contractor shall conduct the testing described in the QAPP that will be developed as part of Task 2. The decontamination line procedure is included as Attachment A. This procedure may be modified based on data obtained in this project. For example soap and water may be used in place of pH adjusted bleach to remove spores from personnel.

One additional aspect that shall be considered is the transfer of samples from the hot zone to the cold zone.

The contractor shall develop the health and safety research protocol (HSRP) for this work and obtain approval from the contractor and U.S. EPA health and safety officers prior to commencement of any studies.

Task 5 – Reporting
All data collected per the QAPP shall be submitted to the EPA WAM within one week after the completion of the analysis. Submission shall be via posting on the NHSRC share drive and by hard copy to the WAM.

Bi-weekly meetings shall be scheduled between the contractor WAL and the EPA WAM to discuss relevant results. Meetings may also include other members of the EPA project team.

The contractor shall submit a draft report on the compilation of test results by 1/31/14. The report shall include photographic and graphical documentation, where appropriate, to support the findings. The report shall be provided in both hardcopy and electronic (MS Word) format. The draft report will be reviewed by the EPA WAM and EPA QA Manager. Comments will be sent to the contractor to incorporate into a revised report. The contractor shall revise the report and provide a final draft within two weeks of receiving comments from the EPA WAM.

XII. DELIVERABLE SCHEDULE

- On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, quarterly and cumulative financial expenditures and cost and schedule variance.

- A draft report shall be delivered to the EPA WAM by 1/31/14.

Table 4: Deliverable Schedule

Deliverable	Date
QAPP/Test Plan	1 month after WA award
Data summaries	On-going
Draft Report	1/31/14
Final Report	2 weeks after receiving review comments

XIII. REPORTING REQUIREMENTS

- The Contractor shall prepare Quality Control data reports of all facility-specific data. Each Quality Control report shall be in a format suitable for EPA/NHSRC publication and shall discuss how well various measurements described in the QA plan were met.
- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.
- In lieu of a final technical report, journal papers within each task may be submitted at the discretion of the EPA WAM. The papers shall be authored or co-authored by the EPA WAM, at the discretion of the WAM. To serve in lieu of the final report, the journal articles must contain all of the relevant information that would have appeared in the final report.
- All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

Attachment A

Long Term Decontamination Line Procedure

	Decontamination Line SOG "Long Term Biological Decontamination Line"	ERTG sub-committee on Bio Decon SOGs	
		Revision 3.0	Issue Date 6/15/2010

Purpose and Scope

The purpose of this standard operating guideline (SOG) is to provide guidance to EPA and contractors on decontamination (decon) for personnel in long term responses to biological contamination. This SOG was developed specifically for a biological response where Level C Personal Protective Equipment (PPE) with a full-face powered air purifying respirator (PAPR) is used. Level C PPE is appropriate for the majority of BioAgents and is required when the concentration and type of airborne substances is known and the criteria for using air purifying respirators are met (OSHA 1999). Level C equipment includes a protective Saranex™ or equivalent coverall with integral hood and booties, an air purifying respirator (preferably a PAPR), inner and outer nitrile gloves, hard hat (optional) and disposable latex outer boot covers.

Personnel Decon Procedure

This SOG has been developed for long-term sites; therefore, the decon line should be constructed with materials durable enough to withstand continued use for a dedicated time period. If possible, decon tent or structures should be utilized and placed under negative pressure with HEPA filtration. Tents, berms, and collection vessels should be able to maintain copious amounts of wastewater in a contained and safe manner. Procedures should be in place to treat and replace contaminated materials used during the decon process as well as replace necessary chemicals and decontamination solutions.

All personnel are required to familiarize themselves with the site-specific decon procedures prior to entering the hot zone. This includes an initial walk though of the decon line prior to entry into the hot zone. The decon attendants will verbally direct decon entrants through each step of the process. Step 1 below will be conducted in the Hot Zone (exclusion zone). Steps 2-7 will occur in the Warm Zone (contamination reduction zone) and steps 8 & 9 will occur in the Cold Zone (support zone).

The "Long Term Biological Decon Line" SOG consists of the following steps:

Step #1 **Equipment Drop:** Place equipment taken into the Hot Zone on a plastic covered table or container provided prior to entering the contamination reduction corridor. Equipment will either be reused if more than one entry is planned, or will be decontaminated at a later time.

Step #2 **Sample Drop:** Place samples in provided container for sample decon. Care needs to be taken to ensure that workers maintain custody of samples. It is recommended that samples are decontaminated in a separate decon line.

Step #3 **Outer Boot and Glove Wash:** The purpose of this step is to enable physical removal of gross contamination if contamination is visible. If gross contamination is not visible, this step may be skipped. Wash outer boots and then outer gloves using a designated decontaminating agent such as soap and water, trisodium phosphate substitute, Alconox or amended bleach.

Step #4 **Glove, Boot, and Suit Wash:** Turn PAPR off and covert cartridges to ensure that the filters are not saturated. Wash all outer surfaces in a contained area (such as a kiddie pool) using a pressurized spray with the designated decontamination solution. Start with decontaminating the boots and gloves, then work on the suit from the top down, including the PAPR casing. Decon personnel should conduct this step. Care should be taken to ensure that all areas are decontaminated, including around the zipper, arms, front torso, and any other area that could have come in contact with contamination. The solution used for decontamination should be contained, collected, and disposed of properly from the decontamination line.

Step #5 **Outer Glove, Boot, and Suit Removal**: While sitting on a stool, remove outer boots and outer gloves. Undo the PAPR belt and hold in hand. While touching only the inside of the suit, remove outer suits by carefully rolling the suit in an outward motion from the shoulders down to your feet. Dispose of boots, gloves and suit in a designated container. This step may require decon personnel to assist either by holding PAPR unit or assisting in suit removal.

Step #6 **Mask Removal:** With inner gloves, remove the mask. Remove cartridge filters and place into designated container. Put mask into mask wash. Decon personnel will clean each mask and PAPR assembly prior to return to service.

Step #7 **Inner Glove Removal:** Remove inner gloves by only touching the outside of the first glove and then only the inside of the second glove. Place gloves into designated container.

Step #8 **Personal Shower (Optional):** If available, personnel should shower using copious quantities of soap and water for a minimum of 5 minutes, and change into clean clothes. If a personal shower is not immediately available then, at the minimal, hands and face should be washed thoroughly

Step #9 **Medical Monitoring:** Report to the medical monitoring station for your post entry monitoring and to the appropriate personnel for debriefing.

Emergency Egress Corridor: An emergency egress line must be established. This line will be used to quickly decon personnel who have medical emergencies while in the hot zone. Personnel must be decontaminated prior to receiving treatment from emergency medical technicians or transported to a hospital.

Hand-Wash Station: A hand-wash station maybe available for personnel to clean up following entry. However, this may not be available initially at the scene or weather conditions may prohibit their use. If a hand-wash station is not available, it is recommended that personnel wash their hands and face as soon as possible.

Disposal of Decon Waste: Waste water will be transferred by sump pumps (or similar) to drums or large scale containers (Baker tanks) and treated (shocked) with amended bleach. The NDT is working to determine waste issues. An optional method may be to place adsorbent diapers in the bottom of the pool to soak up the water.

Breaking down the decon line will require consideration of sampling results. All disposable items will be double bagged and secured until sample results are received and evaluated. Liquid and solid waste will be kept separate and treated as if contaminated until sample data demonstrates otherwise.

Sample Decon Line: Sample Decon procedures will be based on site criteria or will follow the protocol from the lead forensic team (FBI or NCERT). The sample decontamination and packaging requirements will be site-specific and will be outlined in the sampling and analysis plan following consultation with the analytical laboratory. The laboratory will provide information on appropriate decon solutions as well as packaging requirements for receiving the samples. During sample decon, the chain of custody must be maintained.

Upon collection, samples will be place into sample container and then placed into a plastic bag. The following steps maybe used to decontaminate samples:

Step #1 Wipe the outside of the plastic bag with a laboratory approved solution. Under most circumstances this will be the same wipes used for personal decon.

Step #2 Place each individual sample into another plastic bag.

Step #3 Place all samples into a clean over-pack, such as a larger plastic bag or a sealable cooler, with appropriate paperwork and custody seals for transport to laboratory.

Equipment Decon: All equipment staged at the equipment drop must be appropriately decontaminated prior to being put back into service.

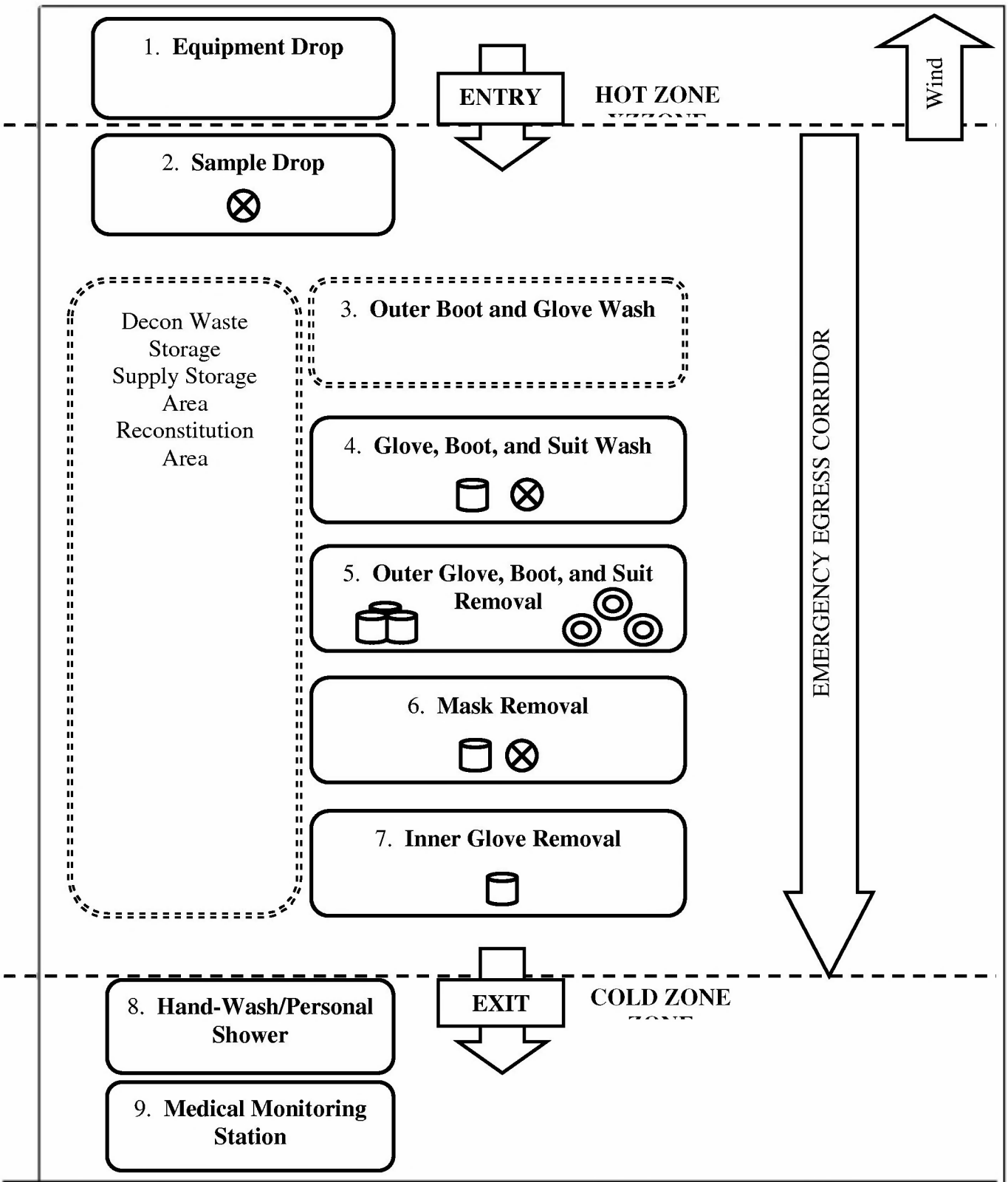
References

CDC (2008). Guidance on Emergency Responder Personal Protective Equipment (PPE) for Response to CBRN Terrorism Incidents. DHHS, NIOSH..

NIOSH (1985). Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH, OSHA, USCG. EPA.

NIOSH (2009). "Recommendations for the Selection and Use of Respirators and Protective Clothing for Protection Against Biological Agents" NIOSH Publication Number. 2009-132

29 CFR, Part 1910, Section 134, Respiratory Protection.



	"Long Term Bio Decontamination Line" Diagram	Decon Wipe; Stool; Waste Container; Catch Basin; Tarp/Visqueen	
	ERTG sub-committee on Bio Decon SOGs	Revision 1.0	July 13, 2010

NHSRC QUALITY ASSURANCE REQUIREMENTS FORM

Attachment 1 to the Statement of Work

I GENERAL INFORMATION

Title:	Decontamination Line Protocol Evaluation for Biological Contamination Incidents
Description:	Determine the effectiveness of each stage in the decontamination line procedure in preventing cross contamination.
Project ID:	DCMD C.2.3.1.07
Status:	Original
Number Ammended:	
QA Category:	III
Action Type:	Extramural
Peer Review Category:	III
Security Classification:	Unclassified
Project Type:	Applied Research
QAPP Status 1:	Not Delivered
Vehicle Status:	Existing Vehicle
Vehicle Type:	Vehicle Number: EP-C-09-027
	Work Assignment Number: 4-77
	Delivery/Task Order Number: NA
	Modification Number: NA
	Other: NA

*If you are processing an **IAG** or **CRADA**, the responsibility for QA must be negotiated within the agreement. The TLPs in consultation with the QAMs in the various organizations must agree on, and document, which organization will take the lead for QA, the names of the QAM and TLP from each organization, and the QA requirements that will be adhered to during the agreement. Include this info in the IAG/CRADA package.*

II SCOPE OF WORK

Yes — Does the Statement of Work contain the appropriate QA language?

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with the R-2 and R-5 and/or the attachments provided with the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf

Yes — Does this extramural action involve the collection, generation, use, and/or reporting of environmental data; the design, construction, and operation of environmental technologies; or development of software, models, or methods?

(If "No" then skip to Section IV, and sign the form.)

No — Will the SOW or any subsequent work assignments or task orders involve any cross-organizational efforts within EPA?

No — Has a QAPP already been approved for the activities specified in the SOW?

No Is an applicable QAPP in the process of being prepared, revised, or approved by EPA personnel for future use by the contractor? (QA approval must be obtained before the contractor can start work.)

III QA DOCUMENTATION OPTIONS

All documentation specified under "Other" must be defined in the NHSRC Quality Management Plan and be consistent with requirements defined in EPA Manual 5360 A1. For all items checked below, there must be adequate information in the SOW (or its appendices) for the offeror to develop this documentation. Where applicable, reference a specific section of the SOW. *(R-2 refers to EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, 03/20/01) and R-5 refers to EPA Requirements for Quality Assurance Project Plans (QA/R-5) (EPA/240/B-01/003, 03/20/01). Copies of these documents are available at)*

After Award Documentation

Not Applicable	Documentation of an organization's Quality System. QMP developed in accordance with:
Not Applicable	Combined documentation of an organization's Quality System and application of QA and QC to the single project covered by the contract: Developed in accordance with:
Other	Documentation of the application of QA and QC activities to applicable project(s). Developed in accordance with:
	Explain: The QAPPs shall be developed in accordance with the attachment #1 (QAPP requirements for applied research projects)
n/a	Programmatic QA Project Plan with supplements for each specific project, developed in accordance with:
Documentation will be identified in individual Statements of Work	Existing documentation of the application of QA and QC activities will be used:

IV SIGNATURE BLOCK

The signatures below verify that the Statement of Work (SOW) has been reviewed to ascertain the necessary QA and QC activities required to comply with EPA Order 5360.1 A2, that the COR understands these requirements, and that the COR will ensure that the quality requirements indicated on the previous pages of this form are incorporated into all associated SOWs. *(Sign/date below, obtain a concurrence signature from the QA Staff, and submit the form along with the other extramural action documentation.)*

Shannon Serre NHSRC-IO Technical Lead Person	02/08/2013 Date	Ramona Sherman NHSRC-IO QA Staff Member	02/08/2013 Date

QAPP REQUIREMENTS FOR APPLIED RESEARCH PROJECTS
(from Appendix B of the NHSRC QMP)

An applied research project is a study to demonstrate the performance of technologies under defined conditions These studies are often pilot- or field-scale. The following requirements should be addressed as applicable

SECTION 0.0, APPROVAL BY PROJECT PARTICIPANTS

The EPA Technical Lead Person (TLP) shall be responsible for obtaining signatures of appropriate project participants on the signature

page of the QA plan, documenting agreement to project objectives and the approach for evaluating these objectives.

A distribution list shall be provided to facilitate the distribution of the most recent current version of the QAPP to all the principal project participants.

SECTION 1.0, PROJECT DESCRIPTION AND OBJECTIVES

1.1 The purpose of study shall be clearly stated.

1.2 The process, site, facility, and/or environmental system to be tested shall be described.

1.3 Project objectives shall be clearly stated and identified as primary or non-primary.

SECTION 2.0, PROJECT ORGANIZATION

2.1 Key points of contact for each organization involved in the project shall be identified.

2.2 All QA Managers and their relationship in the organizations(*i.e.*, location within each organization) shall be identified with evidence that the QA Manager is independent of project management.

2.3 Responsibilities of all other project participants and their relationship to other project participants shall be identifiedmeaning that organizations responsible for planning, coordination, sample collection, sample custody, measurements (*i.e.*, analytical, physical, and process), data reduction, data validation, and report preparation shall be clearly identified.

SECTION 3.0, EXPERIMENTAL APPROACH

3.1 The general approach and the test conditions for each experimental phase shall be provided. The statistical methods that will be used to evaluate the data (*i.e.*, ANOVA, or summary statistics) should be identified.

(NOTE: As deemed appropriate to the project by the TLP, the information requested in Sections 3.2, 3.3, and 3.4 may be presented here or in Section 4; the information requested in Sections 3.5 may be presented here or in Section 5; and the information requested in Sections 3.6 may be presented here or in Section 7.)

3.2 The sampling strategy shall be included and evidence must be presented to demonstrate that the strategy is appropriate for meeting primary project objectives, *i.e.*, a description of the statistical method or scientific rationale used to select sample sites and number of samples shall be provided.

3.3 Sampling/monitoring points for all measurements (*i.e.*, including locations and access points) shall be identified.

3.4 The frequency of sampling/monitoring events, as well as the numbers for each sample type and/or location shall be provided, including QC and reserve samples.

3.5 All measurements (*i.e.*, analytical [chemical, microbiological, assays], physical, and process) shall be identified for each sample type or process, and project-specific target analytes shall be listed and classified as critical or noncritical in the QAPP.

3.6 The planned approach (statistical and/or non-statistical) for evaluating project objectives shall be included.

SECTION 4.0, SAMPLING PROCEDURES

4.1 Whenever applicable, the method used to establish steady-state conditions shall be described.

4.2 Known site_specific factors that may affect sampling/monitoring procedures shall be described.

4.3 Any site preparation needed prior to sampling/monitoring shall be described.

4.4 Each sampling/monitoring procedure to be used shall be discussed or referenced. If compositing or splitting samples, those procedures shall be described.

4.5 For samples requiring a split sample for either QA/QC purposes or for shipment to a different laboratory, the QAPP shall identify who is responsible for splitting samples, and where the splitting is performed (*e.g.*, field versus lab).

4.6 If sampling/monitoring equipment is used to collect critical measurement data(*i.e.*, used to calculate the final concentration of a critical parameter), the QAPP shall describe how the sampling equipment is calibrated, the frequency at which it is calibrated, and the acceptance criteria for calibration or calibration verification as appropriate.

4.7 If sampling/monitoring equipment is used to collect critical measurement data, the QAPP shall describe how cross-contamination between samples is avoided.

4.8 The QAPP shall include a discussion of the procedures to be used to assure that representative samples are collected.

4.9 A list of sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis, shall be specified.

4.10 Containers used for sample collection, transport, and storage for each sample type shall be described.

4.11 Describe how samples are uniquely identified.

4.12 Sample preservation methods (*e.g.*, refrigeration, acidification, *etc.*), including specific reagents, equipment, and supplies required for sample preservation shall be described.

4.13 Holding time requirements shall be noted.

4.14 Procedures for packing and shipping samples shall be described.

4.15 Procedures to maintain chain of custody (*e.g.*, custody seals, records) during transfer from the field to the laboratory, in the laboratory, and among contractors and subcontractors shall be described to ensure that sample integrity is maintained.

4.16 Sample archival requirements for each relevant organization shall be provided.

SECTION 5.0, TESTING AND MEASUREMENT PROTOCOLS

5.1 Each measurement method to be used shall be described in detail or referenced. Modifications to EPA approved or similarly validated methods shall be specified.

5.2 For unproven methods, verification data applicable to expected matrices shall be included in the QAPP meaning the QAPP shall provide evidence that the proposed method is capable of achieving the desired performance.

5.3 For measurements which require a calibrated system, the QAPP shall include specific calibration procedures applicable to each project target analyte, and the procedures for verifying both initial and continuing calibrations(including frequency and acceptance criteria, and corrective actions to be performed if acceptance criteria are not met).

SECTION 6.0, QA/QC CHECKS

6.1 At a minimum, the QAPP shall include quantitative acceptance criteria for QA objectives associated with accuracy, precision, detection limits, and completeness for critical measurements (process, physical, and analytical, as applicable) for each matrix.

6.2 Any additional project-specific QA objectives shall be presented, including acceptance criteria. This includes items such as mass balance requirements.

6.3 The specific procedures used to assess all identified QA objectives shall be fully described.

6.4 The QAPP shall list and define all other QC checks and/or procedures (*e.g.*, blanks, surrogates, controls, *etc.*) used for the project, both field and laboratory.

6.5 For each specified QC check or procedure, required frequencies, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met shall be included.

SECTION 7.0, DATA REPORTING, DATA REDUCTION, AND DATA VALIDATION

7.1 The reporting requirements (*e.g.*, units, reporting method [wet or dry]) for each measurement and matrix shall be identified.

7.2 The deliverables expected from each organization responsible for field and laboratory activities shall be listed.

7.3 Data reduction procedures specific to the project, and also specific to each organization, shall be summarized.

7.4 Data validation procedures specific to each organization used to ensure the reporting of accurate project data to internal and external clients shall be summarized.

7.5 Data storage requirements for each organization shall be provided.

7.6 The product document that will be prepared for the project shall be specified(*e.g.*, journal article, final report, *etc.*). The contents of this document can be referenced to a NHSRC or program-specific QMP, if appropriate.

SECTION 8.0, ASSESSMENTS

8.1 The QAPP shall identify all scheduled audits (*i.e.*, both technical system audits [TSAs] and performance evaluations [PEs]) to be performed, who will perform these audits, and who will receive the audit reports.

8.2 The QAPP shall provide procedures that are to be followed that will ensure that necessary corrective actions will be performed.

8.3 The responsible party(-ies) for implementing corrective actions shall be identified.

SECTION 9.0, REFERENCES

References shall be provided either in the body of the text as footnotes or in a separate section.

Attachment # 2

NHSRC QA
To the Statement of Work
Requirements/Definitions List

EPAs Quality System Website: http://www.epa.gov/quality
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html
EPA's Quality System Website: http://www.epa.gov/quality/qs-docs/r5-final.pdf

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) **a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;**
(2) **an organizational chart showing the position of the QA function;**
(3) **delineation of the authority and responsibilities of the QA function;**
(4) **the background and experience of the QA personnel who will be assigned to the project; and**
(5) **the organization's general approach for accomplishing the QA specifications in the SOW.**

NHSRC QA Requirements/Definitions List
Category Level Designations (determines the level of QA required):

☐ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP: QAPP** requirements for the specific project type (see below).

☐ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP QAPP** requirements for the specific project type (see below).

Project Types:

These outlines of NHSRC's QAPP Requirements for various project types, from Appendix B of the NHSRC QMP (except where otherwise noted), are condensed from typically applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These lists and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

☐ **Applied Research Project** - pertains to a study performed to generate data to demonstrate the performance of accepted processes or technologies under defined conditions. These studies are often pilot- or field-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Applied Research Projects" from Appendix B of the NHSRC QMP.

☐ **Basic Research Project** - pertains to a study performed to generate data used to evaluate unproven theories, processes, or technologies. These studies are often bench-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Basic Research Projects" from Appendix B of the NHSRC QMP.

☐ **Design, Construction, and/or Operation of Environmental Technology Project** - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" G-11, at

[illegible] For additional information, you may refer to Part C of "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology," ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995.

☐ **Geospatial Data Quality Assurance Project** - pertains to data collection; data processing and analysis; and data validation of geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" G-5S at [illegible]

☐ **Method Development Project** - pertains to situations where there is no existing standard method, or a stancard method needs to be significantly modified for a specific application. The QAPP shall address all requirements listed in "QAPP Requirements for Method Development Projects" from Appendix B of the NHSRC QMP.

☐ **Model Development Project** - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" G-5M at [illegible]

☐ **Sampling and Analysis Project** - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information. The QAPP shall address all requirements listed in "QAPP Requirements for Sampling and Analysis Projects" from Appendix B of the NHSRC QMP.

☐ **Secondary Data Project** - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. The QAPP shall address all requirements listed in "QAPP Requirements for Secondary Data Projects" from Appendix B of the NHSRC QMP.

☐ **Software Development and Data Management Project** - pertains to software development, software/hardware systems development, database design and maintenance, data validation and verification systems. The QAPP shall address all requirements listed in "QAPP Requirements for Software Development Projects" from Appendix B of the NHSRC QMP.

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 [illegible]

fi-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r5-final.pdf

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Technical Lead Person (TLP) - This person is technically responsible for the project. For extramural contract work, the TLP is typically the contracting officer's representative (COR). For intramural work, the TLP is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
NRMRL	National Risk Management Research Laboratory	QAM	Quality Assurance Manager
QA ID	Quality Assurance Identification	QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan	SOW	Statement of Work
QS	Quality System	CRADA	Cooperative Research & Development Agreement
TLP	Technical Lead Person		

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-78

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014 Base Option Period Number 4	Novel Sampling Techniques for

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2):

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: John Kinsey (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4121 FAX Number:
Project Officer Name: Kevin Sudderth (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates William Yates (Signature) 7-22-13 (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number:

STATEMENT OF WORK
Work Assignment No. 4-78

Title: Novel Sampling Techniques for Measurement of Aircraft Volatile and Non-Volatile Particulate Matter (PM) Emissions

Work Assignment COR:

John Kinsey
U. S. Environmental Protection Agency
National Risk Management Research Laboratory
NRMRL-APPCD, MD E343-02
Research Triangle Park, NC 27711
(919) 541-4121; Fax (919) 541-0359
E-mail: kinsey.john@epa.gov

Background

Aircraft PM is formed in the engine combustor due to incomplete combustion of fuel, and in the atmosphere through gas-to-particle transformations of organic and sulfur-based volatile components upon cooling and mixing with the atmosphere. PM emitted from the engine at exit temperatures and pressures are defined as non-volatile, whereas those formed via gas-to-particle conversion in the atmosphere are known as volatile PM. Accurate measurement of non-volatile PM from aircraft engines is a daunting task due to the harsh environment found at the engine exit, particle losses during transport in the sample lines, and physical and chemical transformations of the sample as it is transported to analytical instrumentation. Reliable measurements of volatile PM are even more challenging as these are formed in the exhaust plume and are greatly influenced by ambient conditions and composition of the volatile species.

The Oak Ridge National Laboratory (ORNL)/Air Force Research Laboratory (AFRL)/University of Dayton Research Institute (UDRI) team has developed a vapor particle separator (VPS) to partition volatile and non-volatile components in aircraft engine exhaust and allow the volatile species to be chemically analyzed. In addition, a dilution chamber (DC) was also developed to homogeneously dilute and condition aircraft exhaust for measurement. In a separate effort, Aerodyne Research Inc. (ARI) has developed a condensation dilution probe (CDP) to effectively control the formation of volatile particles to simulate atmospheric processing behavior and to quantify this contribution on the total PM mass emissions. All of these devices have shown excellent potential when tested in laboratory and limited field environments. Further demonstrations of these devices may lead to the development of more reliable methodologies for the measurement of both volatile and non-volatile PM emissions from turbine engines, which can then be used for cost-effective determination of regional PM

emissions for regulatory purposes. The purpose of this Work Assignment will be to help assess the viability of these devices for the measurement of total (volatile and non-volatile) PM emissions from aircraft engines as outlined below.

Scope of Work

The contractor shall assist the EPA in the characterization of the volatile and non-volatile PM as well as the gas-phase precursors downstream of the Oak Ridge/AFRL and ARI dilution systems for comparison to that observed at the 30-m sampling location. This evaluation will utilize exhaust produced by a T-63 engine located at Wright-Patterson Air Force Base, OH (WPAFB). Measurements shall be made using instrumentation and techniques to measure elemental/organic carbon and sulfate mass concentrations. Samples shall be sequentially extracted from the dilution systems and the 30m sampling system and analyzed using appropriate time-integrated and on-line methods (Table 1). The instruments used downstream of the splitter shall quantify: total PM mass; non-volatile soot; volatile organic PM; and volatile sulfur PM contained in the engine exhaust aerosol as well as gas-phase SO_2 and total hydrocarbons (THC). Using these measurements, the contractor shall assist EPA in performing a mass balance between the total particle phase emissions, its components, and gas phase precursors as compared to predictions made using fuel composition (e.g., sulfur).

Table 1. Instrumentation and analytical methods.

Test Parameter	Measurement Method	Type of Sample	Instruments/Sampling Media
Total PM mass[a]	Gravimetric analysis	Time-integrated	47-mm Teflon filter sampling (power condition specific)
Non-volatile black carbon	Multi-angle absorption photometry (MAAP)	Continuous	Modified Thermo Scientific 5012 MAAP (SuperMAAP)
Volatile particle-phase organics (OC)[a]	Thermal-optical analysis (NIOSH 5040)	Semi-continuous	Sunset Model 3 Semi-Continuous OCEC Carbon Aerosol Analyzer (power condition specific)
Volatile particle-phase sulfur (SO_4)	Ion chromatography	Time-integrated	Water extraction of 47-mm Teflon filter samples (power condition specific)
Gas-phase SO_2	Pulsed fluorescence analysis	Continuous	Thermo Scientific Model 43a
Gas-phase THC	Heated flame ionization detection	Continuous	CA Analytical Model 300 HFID

[a] All filter analyses will be conducted by EPA.

It is anticipated that four specific tasks shall be performed by the contractor as follows:

Task 1: Prepare equipment for deployment at WPAFB
Task 2: Conduct field experiment at WPAFB

Task 3: Data reduction and analysis
Task 4: Prepare input to final report

Work Schedule

The following milestones are applicable to the research:

Task 2: Complete field experiment by September 28, 2013 (tentative)
Task 4: Submit report input to the EPA WACOR by December 1, 2013 (tentative)

Quality Assurance

The contractor shall develop quality assurance documentation as required in Appendix 1 to this Statement of Work. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance staff.

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW) FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function; 07/14/08 A-2
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

□ **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

□ **QAPP Requirements for Software Development Projects**

□ **QAPP Requirements for Method Development Projects**

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

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NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-79

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2014	
	Base X Option Period Number	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2013 To 03/31/2014

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2014 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: John Kinsey	(Signature) / (Date)	Branch/Mail Code: Phone Number: 919-541-4121 FAX Number:
Project Officer Name: Kevin Sudderth	(Signature) / (Date)	Branch/Mail Code: Phone Number: 919-541-3670 FAX Number:
Other Agency Official Name	(Signature) / (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: William Yates	William Yates / 12/20/13 (Signature) / (Date)	Branch/Mail Code: Phone Number: 513-487-2055 FAX Number: